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THE ARMOUR INSTITUTE, CHICAGO.

The Armour Institute in Chicago has added two departments of study that ought to be very popular and productive of excellent results. They are the mechanical and electrical engineering departments. There is a dearth of well trained, practical mechanics who can work with their hands as well as with their brains. Colleges and technical schools all over the country are turning out mentally trained mechanics, but the number of schools is very few that offer a thorough practical manual training—schools suited to educate the great body of working mechanics. In the electrical line there has been more or less of a reason for the lack of well trained men in the fact that the demand has been so great, and the industry so new, that only unskilled men have been obtainable. But this excuse no longer holds good. To-day the demand is as great as ever for educated, well trained men who have a practical knowledge of electrical matters. One of the difficulties in connection with isolated electric lighting plants is that of securing engineers who have the practical knowledge to run the steam plant with skill and economy and at the same time know how to operate and keep in good condition the electrical equipment. Mentally educated men are a drug on the market, while manually trained and educated men are in demand.

THE BELL TELEPHONE PATENTS.

We have received many letters from readers in various parts of the country asking if they are at liberty to make electrical telephones, now that Bell's original patent has expired. In answer we say no. Bell's original patent was granted for 17 years, dated March 7, 1876, and in the fifth clause he claims "The method of, and apparatus for, transmitting vocal and other sounds telegraphically, as herein described, by causing undulations, similar in form to the vibrations of the air accompanying the said vocal or other sound, substantially as set forth."

This claim was held by the Supreme Court to cover any kind of telephonic apparatus in which an undulatory electrical current was used. This patent expired March 7, 1893.

Bell's second patent, dated January 30, 1877, covers the construction of the well-known Bell instrument and the parts thereof. This patent runs for 17 years from its date and will expire January 30, 1894. Not until that date will the public be free to make use of Bell's invention.

Other important patents are held by the American Bell Telephone Company which have long terms to run; these are explained in the company's advertisement on another page, to which we call the special attention of readers.

THE WORLD'S CONGRESS AUXILIARY.

Modern civilization has brought into existence many great questions which are threatening in their tendencies because of a lack of understanding of their cause and remedy. These, like all great questions, require time for their solution. It is necessary to study and analyze them from all points of view and compare the results that have already been obtained, whether these results be good or indifferent, or failures.

A feature of the World's Columbian Exposition which attracts comparatively little attention, yet which has this particular work in view, is the holding of the several congresses under the auspices of the World's Congress Auxiliary.

Never before in the history of the world has there been such a well-planned and broadly conceived effort to call together eminent minds from all parts of the world, representing every progressive movement. Public attention is drawn each year more directly to the needs of the several movements—such as education, science, religion, reformation and the like; and a gathering at which the best thought of the age in each of these movements can be concentrated, the progress made to date be distinctly outlined, and the needs for better and more aggressive work in the future be discussed, cannot well fail to be productive of good results. The programme of each congress is so planned that single theories or one-sided views cannot well control the meetings, and ample time is assigned each congress for carrying on its work. The publications that will be issued by the Auxiliary, giving the results of each congress, will be valuable data from which to gather strength for concentrating greater energy in each line of effort.

THE VALUE OF A PATENT.

Speaking of the value of patents, a business man interested in such things asserts that a patent does not patent in this country. All that the Patent Office does is to give you a paper with some writing on it, and if another man steals your idea, and goes to manufacturing your invention, the Patent Office will not lift a finger to protect you or to stand by its own decision. The fact that you've got a patent is a point in your favor, but you've got to hire lawyers and fight the thief in the courts, and if he can stand it to hire lawyers longer than you, that settles you, and you might as well make him a present of your invention. There are lots of men in the country getting rich on the discoveries of other people. All they had to do was to take 'em and fight the real discoverers into poverty. The Patent Office, to be respected and to be of any use, ought to have the power to cause the stealer of a patent to be sent to prison.—*Railway Review.*

[Concerning the above, we would say the function of the Patent Office is simply to assist and encourage inventors by granting patents for new and useful inventions and discoveries. To attack or to punish people is no part of the duties of the Patent Office.

Property in patents is held under much the same tenure as other property. If a man receives a deed of lands, he is liable to annoyance from infringers, squatters, and other claimants. If anybody invades his rights he has a remedy through the courts and is obliged to employ lawyers to defend his interests and defeat infringers. It is the same with patent property. The courts are always open to the inventor for his protection, and his patent, moreover, gives him certain special facilities in the prosecution of infringers which are not enjoyed by holders of real estate. The infringer of a patent, if he does not obey the mandate of the court and desist from infringement when so ordered, may be at once imprisoned.

Property in patents is just as secure, and the means for its defense just as ample, as for any other species of property. It is true there are occasional litigations concerning patents in which inventors are made to suffer at the hands of powerful and unfeeling corporations; but the same may be said, probably to a greater extent, of innocent holders of other species of property. We think it probable the rights of patentees are better respected and inventors less troubled with infringements than any other class of proprietors.

Every year there are granted some twenty-five thousand new patents; yet the number of lawsuits where deliberate infringement appears to have been attempted may almost be counted on the fingers' ends. Indeed, it must be admitted the number of patent suits of all descriptions is exceedingly small, when we consider the immense aggregate of patents issued, and the additional fact that in nearly nine-tenths of all our manufacturing industries patents, in some form or other, are made use of.—ED. S. A.]

Steam Street Railways in New York and Brooklyn.

The elevated steam street railways of New York and Brooklyn are great conveniences for the public, but they are sources of dirt, din, and danger to many a passing victim in the streets below. Chunks of coal, bolts of iron, hot and cold water, fiery coals, these are only a part of the droppings that fall from the rattling trains. It is a curious fact, however, that many people love to live close to the lines of these roads.

The other day, in New York, a sober burgher was, to his amazement, suddenly knocked down by what he thought was a meteor from the heavens; but it proved to be only a man, who, by reason of a state of dizziness, fell from the elevated railway station to the street below. Both men were considerably hurt, but will recover.

In Brooklyn, Mrs. Hannah Reilly sat at the front window on the third floor of 37 Myrtle Avenue, rocking her infant to sleep. The structure of the Brooklyn Elevated Railroad is about level with the window. A train passed by on its way to the bridge, and at that moment a missile came through the window, partly tearing out the lower sash, and whizzed by Mrs. Reilly's head. She screamed, and, picking up the baby, ran to the dining room to her husband. Blood poured from three gashes in her face and two others in each hand. She fainted, and her husband sent for Dr. Corrigan, of Jay Street.

Mrs. Reilly was still unconscious when the physician arrived, and he had some difficulty in stopping the flow of blood and reviving her. He succeeded finally, and the woman was put to bed in a state of collapse.

A heavy iron bar was found beside the chair in which Mrs. Reilly sat. Broken glass was scattered all over the room. It is supposed the rod flew from the engine of the train which passed at the time.

Steam Engine Saws.

The *Sonora Independent* says:

"The introduction of a new saw for lumber is to be noted—an upright implement, thin like a bandsaw, and having direct steam attachment. At each end of it is a steam cylinder, each of which has but a single steam port. The upper piston head draws the saw and the lower piston up, and the lower piston draws the saw and the upper piston down, each piston drawing the saw, but neither of them pushing it—this causing the saw at all times to be rigid, so that a very thin saw can be employed. Below the lower cylinder are a heavy pair of balance wheels, these giving a steady as well as uniform motion to the saw, and to these balance wheels are connected a pair of rods, the upper ends of which connect with a knuckle joint at the lower end of the saw, thus throwing the lower end of the saw out as it is going up and against the log as it is coming down. The log carriage is operated by the same engine that runs the saw."

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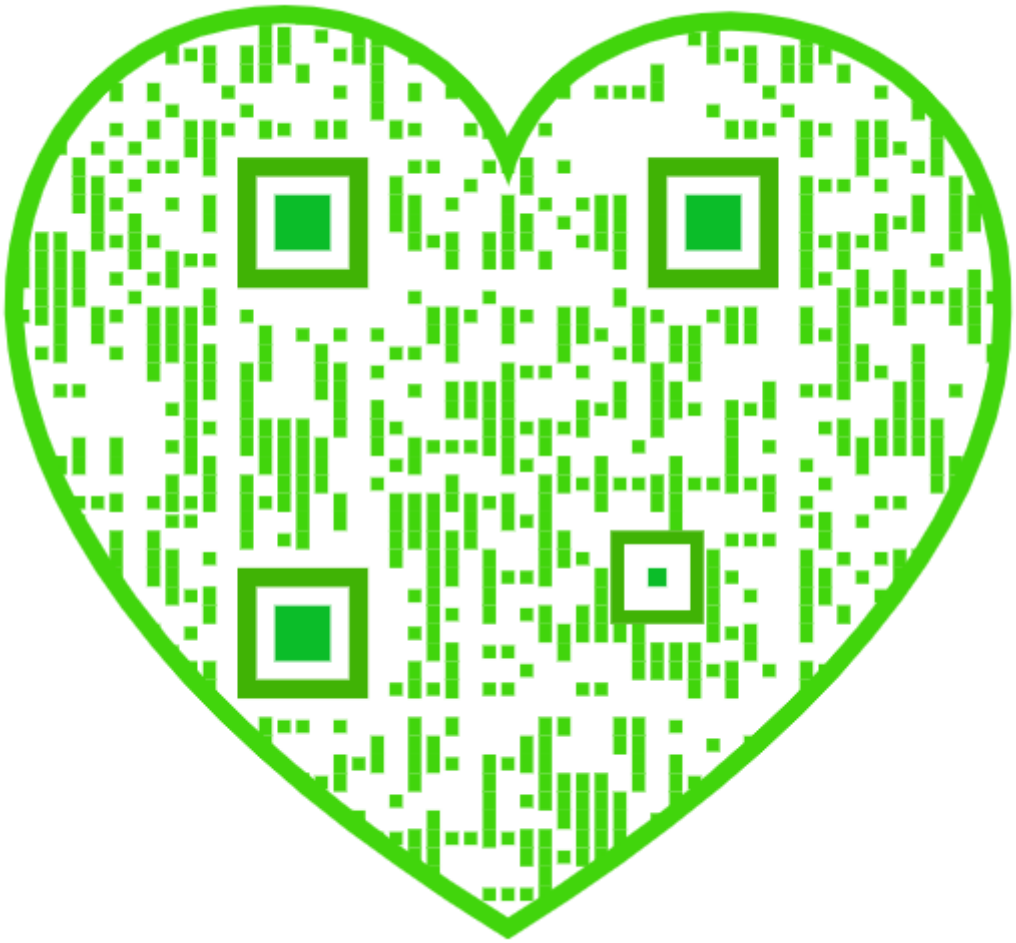

Notes from the World's Columbian Exposition.

The break in the weather has made a decided change in the appearance of things at the World's Fair grounds. The ice and snow have disappeared, the frost is well out of the ground, and with the milder weather outdoor work is being rushed, giving an appearance of more work being done than has been evident for a long time. Piles of rubbish are being cleared away, and preparations are being made to harden the walks and promenades, lay the grass plots and arrange flower beds. During the winter more or less damage has been done to the staff work on the buildings, either by its being cracked off by frost or being broken in one way or another. These broken places are being repaired preparatory to painting the exterior of all the buildings. The painting machines have been overhauled and new ones secured, and at the rate the work is now going on, the buildings will be painted in plenty of time for the opening ceremonies. The work of gilding the dome of the Administration Building is progressing well, and when completed will add greatly to the effect of the view of the grounds as seen outside the park. The work of gilding the Golden Entrance of the Transportation Building is far enough advanced to show what a startling effect this building will have with its polychromatic decorating. It has been christened the "Rainbow Building."

The recent wet weather, together with the melting of snow and ice, showed that there was scarcely a watertight roof on any of the large buildings. There has been more or less trouble from these leaks since the buildings were completed, and the contractors have been requested to make necessary repairs, but have generally failed to do so. Further delay being out of the question, the construction department of the Exposition has now put a large body of professional roofers to work, and little, if any, more trouble will be experienced from this source.

Exhibits continue to arrive by the train load, but during the past month more results could have been accomplished had there been exhibits at hand. Even now there is more delay than there should be, with the opening day so near. Whatever work remains unfinished May 1 will be more from delay on the part of exhibitors than from any fault of the Exposition authorities. Since March 1 all the larger buildings have been near enough completion for exhibitors to begin work of preparing their displays.

In inspecting the buildings that are devoted exclusively to exhibiting purposes, it is a relief to get away from the ever-present staff work and see the Forestry Building, the exterior of which is made of natural woods with the bark intact. A broad veranda extends around the building and the posts that support the roof of this veranda are trunks of trees, three being grouped together for each support, and they comprise all the well-known forest trees. Some of the larger flat surfaces are covered with slabs of bark to complete the general intent of the design. The effect of this building is pleasing and it is appropriately located on the shore of the lake. The other Exposition buildings are covered with staff, and the same is true of many of the State and foreign buildings, and also of the structures of the several concessions in the Midway Plaisance.

Many wild reports have been circulated regarding the amount of money the Exposition will receive from the concessions which have been sold. One statement which has been widely circulated was to the effect that an income of $3,000,000 or more would be received from this source. The fact is, practically every concession is sold on the commission basis, so that the returns received will depend upon the popularity of the several concessions with the visitors. It is safe to say, however, that very substantial returns will be received, as the concessions are numerous and some of them very valuable. Among those inside of the main grounds are the restaurant service, a sea and lake food restaurant, the Japanese tea house, the Esquimaux settlement, the Polish cafe, the clam bake, the moving sidewalk, the cliff dwellers, the intramural railway, the electric launches, the steam launches, the Venetian gondolas, and many smaller ones, such as peanuts, popcorn, etc. Most of the concessions pay about twenty-five per cent of their gross receipts to the Exposition, but in some instances, in which the profits are large, the percentage on the concession corresponds. Thus popcorn pays seventy per cent of the gross receipts for its privilege.

The Midway Plaisance is lined with special concessions its whole length, from Stoney Island Avenue to Cottage Grove Avenue. Among the more important of these concessions are the Irish industries, the Libby Glass Company, the Venetian display, Hagenbeck's animal show, the Irish village, the Japanese bazar, the Natatorium, the Dutch settlement, the Bernese Alps panorama, the German village, the Turkish village, the Moorish village, the streets of Cairo, the Persian concession, the Algerian and Tunisian display, the Morocco exhibit, the Ferris wheel, the Chinese village and theater, the captive balloon, the Dahomey village, the Lapland village, the national Hungarian orpheum, the sliding railway, etc. Extra admissions will be charged to view these special exhibits in the Midway Plaisance, and the Fair will receive a commission on all the income. On merchandise sales the percentage is only five to ten per cent.

It has been a good deal of a question just how to arrange for the payment of these commissions, and the financial managers of the Exposition have considered many plans. The one finally decided upon is the check system. The would-be purchaser finds what his purchases amount to, then buys at a booth, managed by Exposition employes, checks to represent the amount of the purchases, and the check is given in payment of the goods. A corresponding check is retained by the Exposition, having been a coupon as it were to the paying check. In this way the Exposition can handle all the funds, while the holders of concessions are relieved from this bother, and all possibilities of fraud or deception are guarded against. Millions of checks, ranging in price from five cents to one dollar, have been ordered printed for this purpose.

The intramural road is nearly ready to be officially tested. Enough of the power plant is installed to run a train, and one train of four cars is already equipped. The purpose of the holders of this concession is to have the system thoroughly tested at least a month before the opening of the Exposition, in order that its efficiency may be guaranteed. There is nothing novel in the power plant except the enormous size of some of the generators, which will be direct-connected to two Corliss engines. But the method of transmitting the electricity is an entirely new one, as the trolley wire will be between the tracks instead of overhead, as in the usual construction. Each motor car will be fitted with four motors, each of fifty horse power capacity, and will be designed to haul a train of three cars. The cars are richly colored, with the word "Intramural" at the top on each side. Each car will be designed to accommodate 100 people. This road comprises three miles or more of double track. The power house is at the extreme southeast corner of the grounds, and the road extends from near the east side of the Agricultural Building, where there is a loop around the group of buildings, with stations convenient to each of the main buildings and most of the State buildings, the loop at the other end of the line being close to the Fisheries Building.

The building which is to serve as kitchen and storehouse for the restaurant service of the Exposition is now being built. It will be a two-story structure, 125 feet wide and 325 feet long. On the first floor will be a dozen or more large ovens, which will have the capacity for using about 100 barrels of flour a day. On the second floor will be a large dining hall, where most of the Exposition employes will be fed. The building is designed to have a capacity to handle 15,000 pounds of meat a day. It is proposed to have 125 or more eating places inside of the grounds, which will be supplied with food mostly from this kitchen. One large restaurant has already been opened for the benefit of Exposition employes and visitors.

The financial report of the Exposition of all expenditures up to March 1 shows that $15,584,310.16 have been spent, and all but about $2,000,000 of this amount is for construction. The gate receipts up to date are reported to aggregate $205,310.75, showing that 821,243 people have visited the grounds since the admission fee has been charged.

The International Sunday School Association proposes to construct a model Sunday school building near the Fifty-seventh Street entrance to the Exposition grounds. The building is not only to be convenient in design for Sunday school purposes, but also to be a general place of meeting for Sunday school workers, and a central point for the holding of religious services.

Electricians in the employ of the Exposition are hanging arc lamps throughout the buildings and grounds, and in some of the buildings this work is nearly completed.

All of the walks and promenades will be brilliantly illuminated, as the lamps will be placed every seventy-five feet or so. The shores of the lagoon will be almost as light as in daytime, so that at evening sessions of the fair riding in the electric launches and other boats in the lagoons will be one of the most attractive features of the Exposition. The buildings will be correspondingly brilliantly illuminated. In the main building there will be probably 1,200 arc lamps, in addition to a great many incandescent lamps. In the Electricity Building there will be special displays in artistic effects in electric lighting with colored and miniature incandescent lamps, in addition to about 400 arc lamps. The basin will be particularly highly illuminated on open evenings, and for this purpose there will not only be several hundred arc lamps, but also several thousand incandescent lamps, the two electric fountains, and search lights.

A number of brick buildings for hotels and other purposes were rushed up this past winter in the neighborhood of the Fair grounds, and in two or three instances walls which were constructed during the coldest weather, when the mortar froze almost as soon as it was laid, have begun to bulge out. The city department for the inspection of buildings had a sad lesson a few weeks ago, from neglect to order walls torn down which were unsafe and which fell down because of this neglect and caused the loss of several lives. With this lesson in mind, the department is particularly active in watching some of the temporary structures in the neighborhood of the Exposition grounds. In all instances walls that are not safe will be torn down or materially strengthened.

Draining the Okefinokee Swamp.

The work of draining Okefinokee swamp, the biggest undertaking of its character in America, which will eventually reclaim 220,000 acres of the finest agricultural land in the country, is progressing at a remarkably satisfactory rate. The great swamp is situated in the southeastern part of Georgia, and extends northerly from the border line of Florida. Creeks of St. Mary's River and Suwanee reach to the swamp. One of the engineers in charge of the work was in the city recently and gave the writer an interesting chat about the scheme, which will open up a section which for centuries has been under water and muck, the home of alligators and various other reptiles.

One hundred and fifty laborers are now at work at the swamp, and the construction of the great canal, which is to carry the water from the swamp to St. Mary's River, is being pushed forward as rapidly as machinery and human hands can accomplish it. After January 1, this force will be doubled, one-half working during the day and the other at night, so that this year's results will be twice as much as that of the last twelve months.

This canal, when completed, will be 150 ft. wide and 63 ft. deep, with a fall of 125 ft. to St. Mary's River. The most difficult part of the construction will be through a high knoll two miles long. Through the middle of the swamp another canal, sixteen miles long, will be constructed, with small branches, the whole to act as feeders to the big drainage stream.

When the latter is completed, two hydraulic pumps, with a capacity of 30,000 gallons each per minute, will force the water off the swamps, while the largest inland dredger in the world will remove the muck and tear away the stumps, leaving behind a beautiful clay subsoil, which has become wonderfully rich by the muck accumulations of centuries. This muck averages 6 ft. deep. The dredge is a ponderous machine 90 ft. long, with a 40 ft. beam. It is what is known as a combination dipper and stump puller.

By April 1 the company will be able to secure timber from Okefinokee. In this alone the wealth of the swamp is incalculable. Its pine growth is the most magnificent in the world in point of size and quality, and its cypress deposits cannot be equaled anywhere. The pines average 70 ft. to the limb, are as straight as an arrow, and from 1 to 8 ft. in diameter, while the cypress trees are enormous in size, the average diameter being from 10 to 12 ft. Saw mill men have besieged the company to secure the timber, but, as it is of such valuable quality, the company will probably erect saw mills on the edge of the swamp and develop the timber on its own account.

The engineers expect to find many valuable curios as the work progresses. Already they have found evidences of Indian habitation of the numerous small islands which dot the great swamp. Numbers of Indian mounds have been discovered on these islands filled with all styles of pottery, specimens of which have been sent to the Smithsonian Institution at Washington.

The most interesting curiosities, however, are expected when the big dredge begins its work of removing the muck from the swamp. The engineers believe that mammoth wild animals, now extinct, made their homes in the swamp in past centuries, and are anxiously looking forward to the turning up of carcasses to prove their theories.

Just what length of time will be required to complete the draining of Okefinokee the engineers are unable to estimate, but it is safe to say that there is work ahead for several years. When the reclamation is accomplished, the stockholders of the company who had the nerve to put their money into the scheme, which, when first broached, appeared to many as a wild vagary, will realize handsomely on their investments. It may take a long time, but it is one of those things worth waiting for.—*Savannah News.*

A Trolley Balloon Line.

Mr. Opha Moore, of Columbus, O., has proposed a system of aerial navigation which does away with the necessity of transporting a heavy motor. He proposes to use balloons to carry the passengers, and to provide each balloon with an electric motor. The balloon is to be driven from a trolley line. The motor is to actuate a screw. Exactly where this plan surpasses the system of cable traction applied to balloons does not appear. The trolley lines are supposed to act also to hold the balloon on its course. The poles are to be about one hundred feet high. The air ship is to float 40 to 100 feet above them. Parachute descents are proposed, if necessary.

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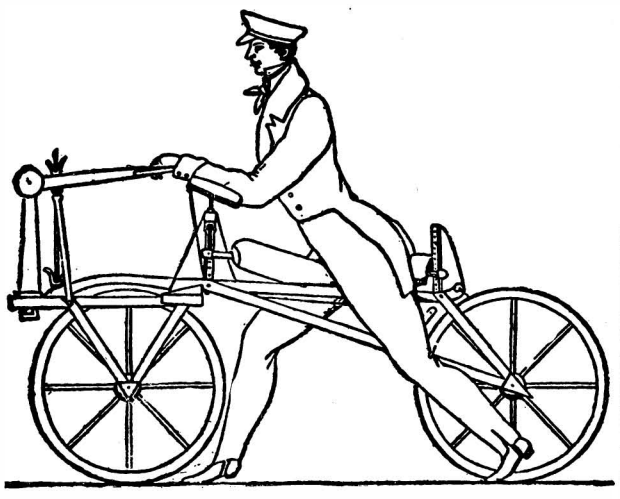
THE BICYCLE INDUSTRY.

BY BEN BOLDER.

The history of the bicycle is rich in all that pertains to crudeness, novelty, and the subsequent rapid development of lines which were the foundation of the



THE "DRAISINE" OF 1816.

modern bicycle of to-day. Since 1816 the inventive genius of man has been at work upon the construction of cycles; but not until 1869, when the American velocipede appeared, can it be said that cycle manufacturing took even the slightest form as an industry. The bicycle of to-day is a radically different affair from that of five or six years ago. Within this period the safety bicycle has superseded the dangerous high wheel; cushion tires have succeeded solid ones, and these in turn have been placed among other back numbers by the more modern pneumatic tire. The highest grade bicycles of 1893, such as the world-famed Victor bicycles, have probably reached that stage of development where many more improvements are improbable, if not impossible. The maximum and minimum in weight have been reached, and it is now assured that from 28 to 35 pounds is the proper standard, varying from the former for a racing wheel to the latter for rough usage and very heavy riders. Above or below these weights is undesirable.

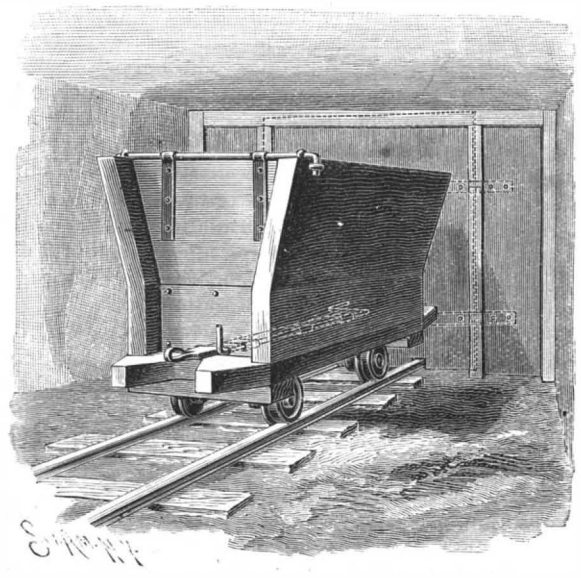
THE VICTOR "FLYER" OF 1893.

Again, art in the manufacture of the bicycle has lightened and beautified the material and lines of design, compensating for weight by a better understanding and application of mechanics, until to-day pleasure, touring, or business trips are equally indulged in by all. The bicycle is coming to be as indispensable as the carriage, simply because the art of bicycle manufacture has made it possible to obtain from the bicycle for business or pleasure that which is impossible from the carriage. Of course there is still much crudeness and imperfection in many bicycles. By far too great a majority are cheap, both in quality and price, and it is even stated that there is but one factory in the world where every part of the bicycle is made complete from A to Z; that is the factory, or rather factories, for there are three of them, being those of Overman Wheel Company, located at Chicopee Falls, Mass., where the Victor bicycles are built complete, without outside assistance. The tires are Victor tires, not those of some part maker; the saddles are Victor saddles, rims Victor rims, and so on. The vast structures devoted to the manufacture of Victor bicycles were all built expressly for the purpose, with the intention of turning out the best and highest grade bicycles in the world at the highest prices.

That the Overman Wheel Company has succeeded goes without saying, and its magnificent plant, complete in every detail, is an object lesson to other makers who desire to reach the summit of fame. The Victor being the first safety bicycle built in America, its makers have always been a little in advance in improved construction. The Victor "Flyer" here illustrated is considered the highest development ever attained. Its contrast to the crude wheel of 1816 is most marked and startling. The Overman Wheel Company has issued an elegantly embossed and printed catalogue for 1893, covering every feature of the Victor product. It is a triumph of the printer's art, and probably the finest catalogue ever devoted to the subject.

AN IMPROVED MINE CAR.

The illustration represents a mine car of simple and durable construction, which has been patented by Mr. Homer Durand, of Starkville, Col. The bottom of the car body extends beyond its ends, and the central portion of the extension is cut away, forming side projections adapted to abut against the door in the mine shaft as the car travels down the track, the car thus automatically opening the door in the shaft. At one

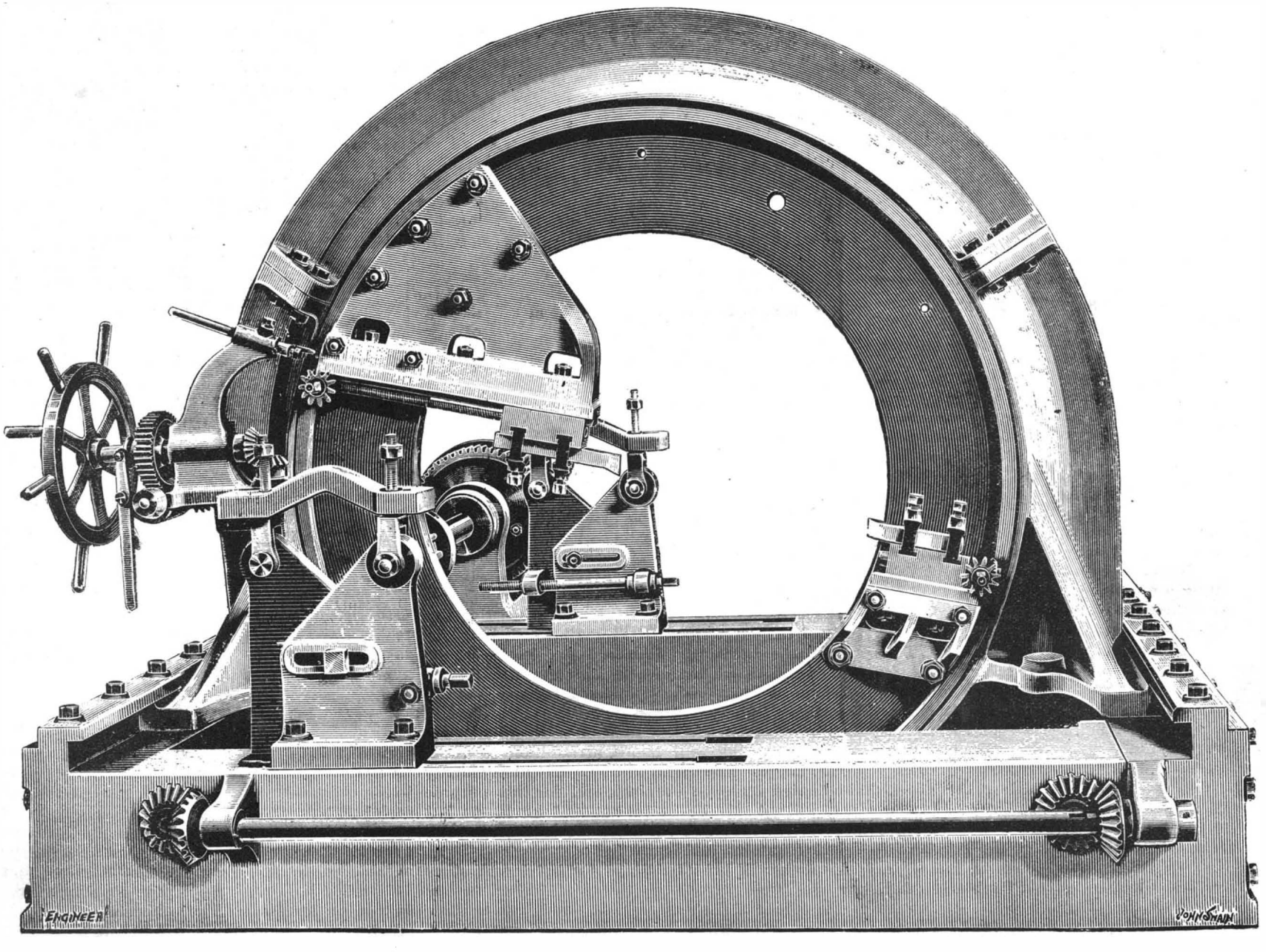


DURAND'S MINE CAR.

end of the car body a door is hung upon a transverse rod, and the door is prevented from swinging outward by a projection on one end of a longitudinal rod turning in suitable bearings, the rod at its other end having a crank arm or handle. When this handle is swung upward the door swings outward to discharge the contents of the car, but when the handle is turned downward the door is locked in closed position.

CRANK SHAPING MACHINE.

The illustration, which is from the *Engineer*, London, represents a crank pin turning machine specially adapted for turning double or single sweep crank necks. As will be seen by the engraving, the machine



IMPROVED CRANK PIN TURNING MACHINE.

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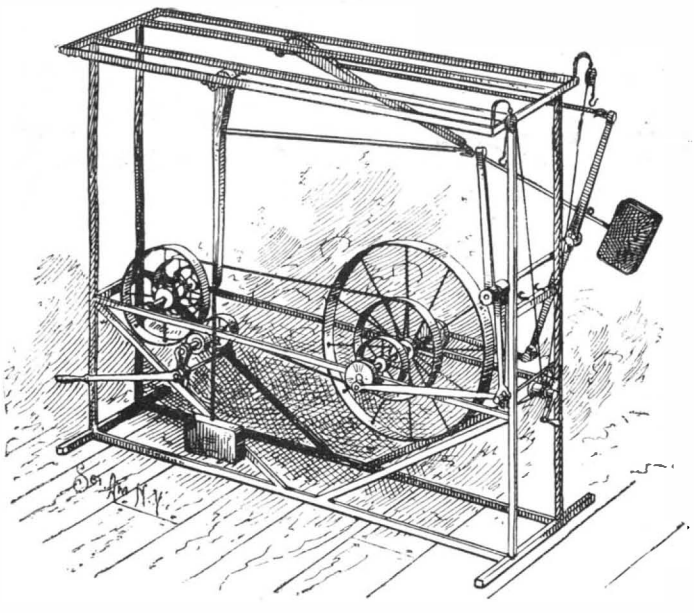
consists of a large internal wheel carried in a V-grooved circular casting, which is supported on a bed frame. The wheel carries the cutting tools, and is driven by a large four-speed cone and double and single purchase gearing. One of the tools is arranged to turn between the crank web, and the other for turning over the top of the webs. The machine is fitted with band and self-acting feed motions, and is capable of admitting cranks having throws up to 18 inches centers. The crank shafts are held secure in two adjustable V blocks, which will admit of shafts from 4 inches to 10 inches diameter, whereby the crank necks are quite true with the body of the shaft, which are otherwise sprung by being held in lathe centers. Machine tools of this kind have hitherto been little used. They are now growing in favor, because their defects have been got over by such firms as Messrs. Booth & Co.

AN IMPROVED MOTOR.

The device shown in the illustration has been invented by Mr. Joseph Havlina, of Rockland, Wis. It is designed when once started to run continuously. The pendulum rods are connected by other rods with cranks on a driving shaft at one end of the machine, the pendulums swinging alternately, so that one is raised while the other is down. On the same shaft are



HAVLINA'S MOTOR.

also cranks extending in opposite directions to connections with pitmen, the two sets of cranks having semi-cylindrical hubs, which may be fastened together if desired, so that the cranks on the two sides of the frame may each be practically in a single piece. The pitmen are connected with cranks on a shaft carrying a large fly wheel, and pulleys belted to other pulleys on a countershaft, from which power may be taken. At one end of the machine is a crank and gear mechanism to turn rollers carrying ropes or cables, by means of which the pendulum rods may be raised one after the other when the machine is to be first started, and there is also a brake mechanism controlled by a lever. By the swinging of the pendulums a rotary motion is given through the pitmen to the fly-wheel shaft and the other pulleys or machinery connected therewith.

AN IMPROVED CRUDE OIL BURNER.

The illustration represents a recent improvement in burners for the combustion of crude oil with the highest degree of efficiency in combination with air and steam, the apparatus being so arranged as to effect a thorough commingling of those elements before the mixture is injected into a furnace. The vaporizing or primary combustion chamber of the apparatus is in the form of a hollow cylinder, G, open at its inner end to allow for the emission of flame therefrom. The vaporizing chamber is secured to the outer end of a furnace (not shown) by means of bolts or other suitable appliances. D represents an injector for forcing oil commingled with steam into the vaporizing chamber, the oil supply pipe leading into a central bore in which is fitted a needle-pointed screw valve regulated by the small hand wheel, B. The inner face of the injector has a series of nipples, each having a single perforation leading from an annular passage of the injector casing in lines parallel with the central axis of a pipe around the oil supply pipe. The inner end of this pipe is secured in a central opening of a front plate which forms a closure for the outer end of the vaporizing chamber, and the front plate also has circular openings corresponding in number and alignment to the nipples of the injector, so that the minute currents of steam issuing from the perforations of the nipples forcibly inject atmospheric air through the circular openings in the front plate from the space between the injector and front plate into the vaporizing chamber.

As soon as the valve, B, is opened to allow the oil to flow into the injector, the steam current forces the oil, reduced to an oily vapor, into the vaporizing chamber, wherein it mingles with the several currents of air injected through the opening in the front plate to produce an intense combustion.

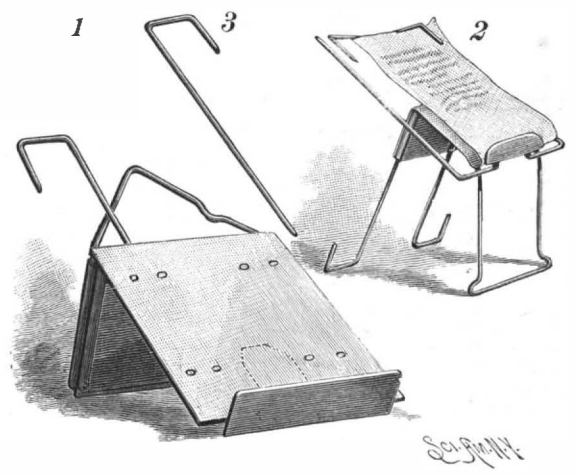
The lifting power of this apparatus is an especially desirable feature, that is, owing to the relative position of the steam and oil points being fixed, its siphoning power cannot be varied by any manipulation of its working parts. Perfect safety is thus insured by having oil supply below level of burner.

It will be readily understood that this improvement affords a reliable oil atomizer and air injector for producing and burning vapor gas developed from liquid fuel. The effective method employed for producing a vapor gas from liquid fuel and steam, combined with the capacity of the apparatus to forcibly inject atmospheric air, in numerous small currents, into the mixing or primary combustion chamber simultaneously with the atomized oil and steam, insures a complete admixture of all the constituents, forming a compound and combustible gas, capable of developing the highest heats and in a manner designed to meet the requirements of the many industries where furnaces are in use.

This new development in devices for economically extracting and utilizing the full means of heat contained in liquid fuels is well deserving of the examination of those who are seeking the best means to attain that end. The apparatus is manufactured by the Shipman Engine Manufacturing Company, Rochester, N. Y.

AN IMPROVED BOOK OR COPY HOLDER.

The simple and inexpensive device shown in the illustration may be manipulated to support copy or a book in such different positions as may be desired, and when not in use may be folded to occupy but small space. The improvement has been patented by Mr. B. Gardinier, of Chippewa Falls, Wis. Fig. 1 shows the holder in position to support a book held open upon a table, Fig. 2 representing it holding papers or notes for typewriters, etc., and Fig. 3 indicating one of the supporting devices. The body of the principal holder is essentially L-shaped, one member constituting the table and the other the support. Slideways are formed upon the under surface of the table member, and on its upper rear end is located an essentially triangular or V-shaped rail, made of stout wire, and adapted to serve as a support for a rod or other piece introduced into the slideways. The front of the body also has a sliding rest, and in connection with the device are employed angular arms of different lengths, as shown in Fig. 3. These arms may be used to elevate the body and also as extension supports for the table, the book or copy laid on the table also resting on the supports. These arms throughout their length are polygonal in cross section, so that they will not turn when introduced into the sockets or slideways of the table, and different forms of legs are employed in connection with the body and the arms. The holder may be conveniently employed for supporting a thin book or magazine or a heavy book, retaining the leaves extended in open position at each side of the center by means of the tongue members of the arms, while also permitting the leaves to be readily turned as desired. This improved holder is said to

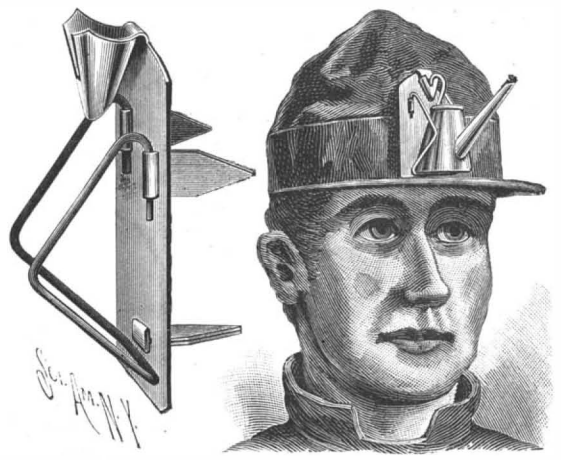


GARDINIER'S BOOK OR COPY HOLDER.

have received especial commendation on account of its ease of manipulation and its adaptability to all sizes and thicknesses of books.

A HAT SUPPORT FOR MINERS' LAMPS.

The device shown in the picture may be quickly and easily attached to an old cast-off hat or cap, or any article of head wear, to hold a lamp in position with as much safety and convenience as may be obtained with hats or caps especially made to carry lamps. The back plate of the bracket is pierced in three places for the reception of a simple form of metal fastening devices, each made of a single piece of metal, and on the front of the upper central portion of the plate is a socket or keeper, made integral with the plate, and bent forward into inverted cone shape. This socket is adapted to receive the hook or handle of the miner's lamp, the lamp being held by its sides and bottom in a guide frame formed of a single piece of wire bent upon itself, the extremities of the wire forming pins, which enter the socket heads of the upper fastening devices. Many miners, using their old headwear, tack on a



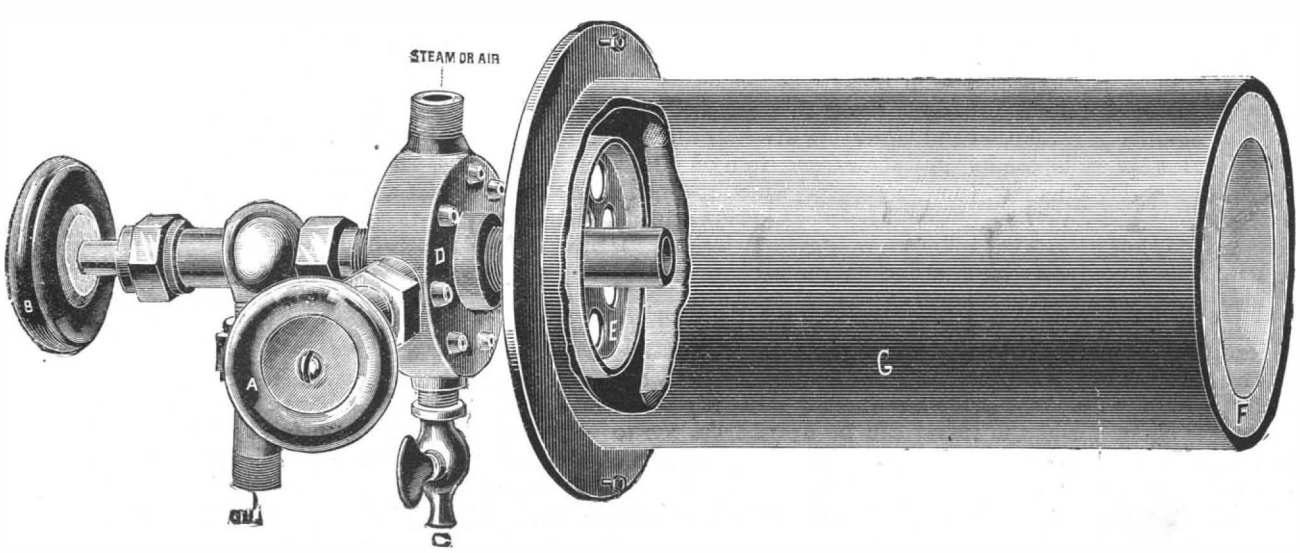
WATTS' BRACKET FOR MINERS' LAMPS.

piece of leather, to which the lamp may be secured, instead of purchasing patent caps with brackets riveted to them; but this improvement is simple and inexpensive, and far preferable to a leather fastening, while it is readily applied to any article of headwear not especially made for mining purposes.

Further information relative to this invention may be obtained by addressing the patentee, Mr. Julius R. Watts, P. O. Box 824, Springfield, Ill.

SUGAR FROM COTTON SEED. — The cotton plant, which has for so many centuries furnished a large part of the population of the globe with clothing, seems to be almost without limit in its usefulness, remarks a scientific authority.

From the seed a valuable oil is expressed, while the husks form an article of food for cattle in the shape of cakes. From the lint which clings to the seed after it has passed through the "gin" felt is made, while the oil extracted from the seed is applied to quite a large number of purposes. But, according to the British consul, Mr. Portal, of Zanzibar, cotton seed is also capable of yielding sugar. A process has been discovered for extracting sugar from cotton seed meal, and, though the details of this process have not been disclosed, it is said that the product obtained is of very superior grade, being fifteen times sweeter than cane sugar and twenty times more so than sugar made from beet. This indicates that sweetness is not due to cane sugar, but to some other chemical.



THE "COLUMBIA" CRUDE OIL BURNER AND AIR INJECTOR.

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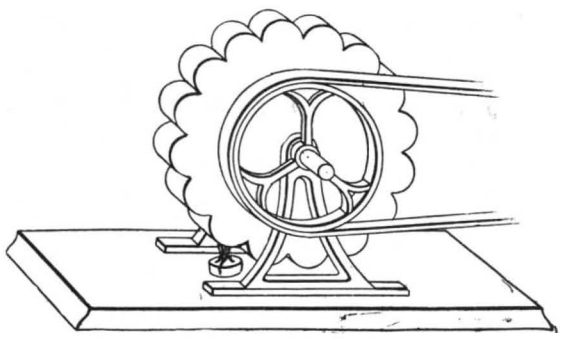
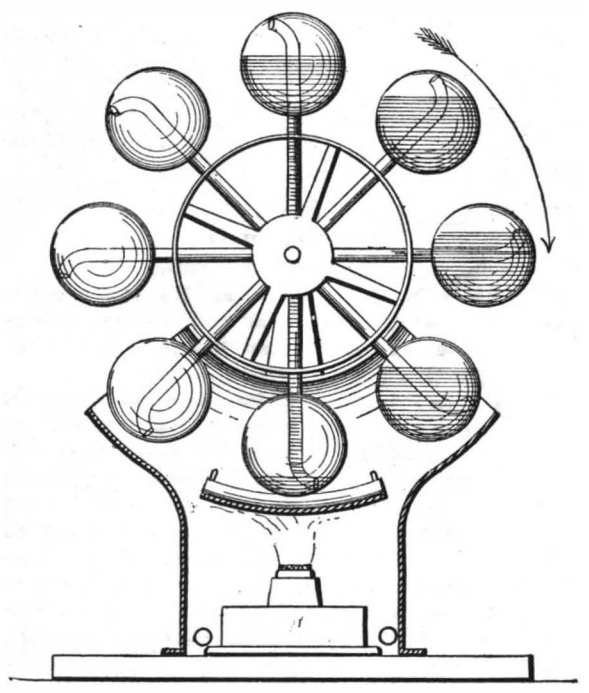
A NOVEL MOTOR.

Mr. Frank Mitchell, of "Bouchon" Works, Redman's Road, E., has patented and perfected an ingenious form of heat motor, which promises to be of great utility in those cases in which small motive power at a trifling cost, involving but little care or attention, is required. This motor consists essentially of a wheel mounted on trunnions. The wheel is hollow and divided into a number of compartments, which are filled with water or other vaporizable fluid, and sometimes charged with a volatile body. The opposite pairs of compartments are connected together and the whole is permanently sealed up. Since no chemical change takes place, one charge is sufficient to last for years of constant work, the wheel being, to all intents and purposes, a solid one.

To set the motor in action, it is sufficient to expose one side of the periphery of the wheel to the sun's rays, to a feeble gas jet, or even to the heat evolved by the human hand held near it. No condenser or any other device for concentrating the sun's rays is needed, and provided the heat be kept constant, no governor is required to insure regular speed. The application of heat on the one side causes a variation in the pressure of the fluid or vapor in the chambers, and this, by upsetting the equilibrium of the wheel, causes it to rotate with considerable force, which is proportion-



MITCHELL'S HEAT MOTOR—ENGLISH PATENT.



ISKE'S HEAT MOTOR—AMERICAN PATENT.

ate to the difference between the heat applied and the normal temperature. One great advantage in this motor is the absence of all risk, and this, conjoined to the fact that it runs perfectly silently and without dirt, is a grand recommendation. A small motor, standing but a few inches in height and actuated by the heat from a common gas burner flame turned down to the size of a small pea, will work a small fan or fountain, etc. I present your readers with an illustration of this novel device, which, in point of durability, promises to be the most durable motor extant.

By this invention Mr. Mitchell has at last solved the problem of obtaining power direct from the sun. The apparatus, when arranged as a sun motor, requires no attention. The enormous advantages this will offer for ventilating and other purposes in countries where the sun's heat is so intense will be obvious.

S. R. BOTTONE.

[The above article, from the *English Mechanic*, does not explain the construction of the motor. We are inclined to think it is similar, if not exactly like, a motor patented by Mr. Albert Iske, of Lancaster, Pa., in 1888. We annex a cut of Mr. Iske's motor and also give an abstract of his description of it.

In this motor bulbs are arranged diametrically opposite each other, in pairs, each pair being connected by a tube. The motor thus formed of the series of bulbs, the tubular arms and the shaft supporting them is operated by the heat of a small lamp. Each pair of bulbs contains enough water to fill one of them. The wheel thus formed revolves over a deflector which is heated by means of the lamp. The bulbs are exhausted of air, so that pressure sufficient to force the water from the bulb at the lower part of the wheel into the bulb at the upper part of the wheel is created by a very slight increase in temperature. The water being thus forced into the upper bulb makes the upper portion of the wheel heavier, thus causing it to turn by its own gravity in the direction indicated by the arrow, bringing the next filled bulb into position for being heated. This operation is repeated as the wheel continues to revolve.—*Eds.*]

The New Naval Observatory Telescope.

The new telescope for the Naval Observatory at Washington has recently been completed by Warner & Swasey, of Cleveland, O. It is entirely new, with the exception of the fine twenty-six inch object glass, and in power is second only to the Lick in this country and is excelled by but two telescopes abroad.

The old mounting for the lenses was built no longer ago than 1870, at a cost of $20,000, but such a revolution has been wrought in appliances and mechanism for handling large telescopes since then that it was necessary to construct a mounting entirely in the new style in order to have the telescope in keeping with the other instruments in what is to be the finest national observatory in the world.

The new telescope will weigh thirty tons, about two-thirds of which comes from the cast iron rectangular supporting pier, in which is built the great clock for driving the telescope in either stellar, solar, or lunar time. By it the star under observation is kept in exactly the center of the field of vision for hours at a time, and it is possible to leave a photographic plate exposed three or four hours with the same results as if the tube and star alike were stationary.

The tube itself is of sheet steel, 38 feet long, 26 inches in diameter at the object glass, 31 at the center, and 24 at the point where the eyepiece is placed. The sheets vary in thickness from one-tenth to one-twelfth of an inch, and have been carefully tested, with a view to bearing all the strain put upon them and maintaining a perfect tube. There is no ornamentation, by polishing or otherwise, except plain black paint. The weight of the tube is 2,000 pounds.

The telescope is equipped for photographic and spectroscopic work and is very complete in all its appliances. One observer will be able to handle the great instrument easily and quickly, so fine and perfect are the adjustments and machinery. The difficulty met in observing a star when it is low in the heavens and the eyepiece is brought high above the floor is overcome by raising the floor by hydraulic rams. The observer touches an electric button in a keyboard by his side and raises or lowers the floor at will.

The clock is wound automatically by electricity. When the weights reach a certain point they switch on an electric current, which is cut off again when they are wound up.

The ease in handling the telescope is increased by the devices to reduce friction. The shaft of the polar axis rests on hardened steel ball bearings resembling those in fine bicycles, and at the top it works on a necklace of anti-friction rolls.

The Siren as a Fog Signal.

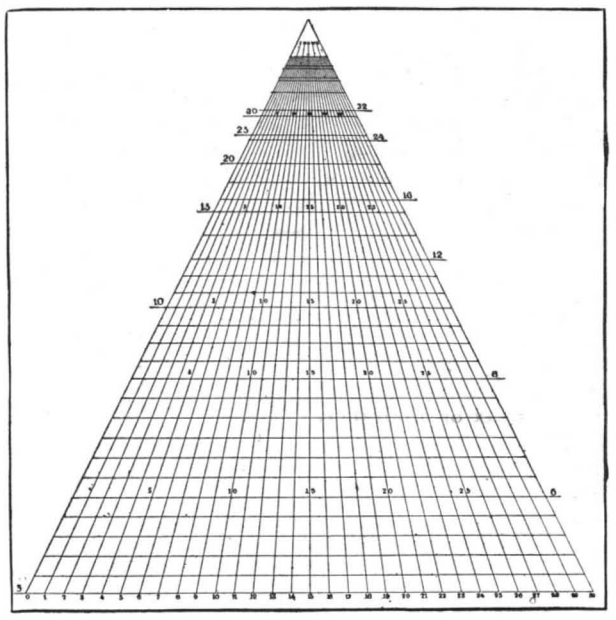
Undoubtedly the siren is one of the best fog signals. Its penetrating, though exceedingly disagreeable, note can be heard farther than any other sound, except, perhaps, an explosion, and it can be given any desired characteristic. Yet of the 255 fog signals of various kinds in the United States, not including whistling and bell buoys, but 18 sirens are now in use. The reason is the expense. There is but one firm in the world that makes them, so this firm has the monopoly and charges accordingly. It is justified in so doing, however, as it spent a great deal of money in perfecting this instrument.

A siren is a simple enough instrument. It consists of two superposed disks, with a certain and like number of holes. One disk is stationary, the other revolves, while at the same time air or steam is forced through the holes. When the holes are opposite each other, the steam will pass; when they are not opposite, the passage of the steam is stopped. Hence when one of the disks revolves, the steam passes in a series of puffs. If these puffs succeed each other with sufficient frequency a note is produced, rising in pitch with the rapidity of revolution and increasing in power with the pressure of the steam. In the present siren the disks are revolved by a small steam engine, which also opens and closes a valve to allow for the passage of the steam, and thus gives what is known as the characteristic, for a siren used as a fog signal does not sound continuously, but gives a certain number of blasts of a definite length per minute. The steam is supplied by a boiler both for the engine and the siren, and, to avoid possible breakdowns, the boilers, engines, and sirens are always in duplicate. The steam pressure is ordinarily about 50 pounds, and the sound can be heard from ten to fifteen miles, and occasionally much farther, depending on the weather.

The same firm which makes the sirens makes also a very much cheaper and nearly as effective an instrument known as the "self-acting siren," which requires no engine and which is much used on the transatlantic steamers in place of steam whistles. The steam itself revolves the disks, and the blasts are given by simply opening the valve by hand. The speed of revolution of the disks is automatically regulated by an ingenious centrifugal brake. A self-acting siren would make an admirable fog signal if it could be given a characteristic automatically. This is accomplished by the use of "Crosby signal," a clockwork device, which can be set to automatically open the steam valve any definite number of times per minute, the clock being also wound up automatically each time the siren is blown. One of these fog signals has lately been installed at Execution Rock light station, Long Island Sound. It consists of two locomotive boilers with their accessories, two self-acting sirens, and two Crosby signals, so arranged that either boiler and either Crosby signal can actuate either siren. The sound has been heard a distance varying from eight to seventeen miles. The cost of a first-order siren in duplicate, without boilers, is $4,800. The cost of the self-acting siren and Crosby signal in duplicate, without boilers, is $925. The Crosby signals are manufactured by the government, the light-house board having bought the patent.—*Marine Review.*

THE UNIVERSAL SCALE.

The scale by J. Ernest G. Yalden, 144 West 94th Street, New York, consists of a triangle having a base of 6 inches and an altitude of 6 inches. The base is divided into 30 parts. These parts are connected with the apex of the triangle by radial lines. Lines parallel to the base are drawn through the triangle, to enable one to hold parallel to the base the paper on which the divisions are to be taken.



THE UNIVERSAL SCALE.

To divide a line of unknown length into any number of equal parts:

Mark on the edge of a strip of paper the length of the line as taken from the drawing. Let us suppose it is to be divided into 12 parts. Fit it between the 0 and 12 radial lines on the scale by sliding it up and down till it fits, keeping the edge of the paper parallel to the base of the triangle. Mark the 12 parts, and then apply it to the drawing, using it as a scale.

This is far more accurate than the usual method of drawing parallels from points on a line drawn through one end of the given line. It takes far less time and does not deface the drawing. The draughtsman can construct in like manner a scale to fit any case, and which may be used in the same manner as a scale. Other applications will be obvious.

Rupture of Intestine Caused by a Tapeworm.

In a recent number of the New York *Medical Journal*, Dr. Fayette Dunlap describes a case of resection of the small intestine for rupture caused by a tapeworm. When he saw the patient he believed that there was an ectopic gestation with ruptured sac. On the abdomen being opened the pelvis was seen to be filled with recent blood-clot, and a tapeworm was found protruding from a large ragged rupture in the small intestine. About two-thirds of the lumen of the intestine was gone, the edges were ragged and gangrenous, but it was quite evident that there had been no previous ulceration. The damaged part was resected and the ends united by the continuous suture after the manner of Lembert. Vomiting was continuous for thirty hours after the operation and only ceased after a large enema of an ounce each of glycerine and sulphate of magnesium and a quart of *hot* water. From the abdomen there was removed about eight feet of live tapeworm, and with the enema there came away seventeen feet more. Dr. Dunlap thinks the worm had become entangled, and in the effort to free itself so eroded the wall as to cause rupture. No antiseptics were used. The patient made a good recovery.

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THE NEW COAST DEFENSE WAR SHIP TERROR.

The Terror, now fast approaching completion at the navy yard, Brooklyn, is of the class of double turret coast defense monitors with sides armor-plated their entire length. The side plating, now being made, is 7 inches thick by 6 feet in depth from the deck.

The Terror is 250 feet in length, 53 feet beam, 14 feet draught, 3,815 tons displacement, mounting four 10-inch breech-loading rifles in two turrets fore and aft, as shown in Fig. 2. The turrets are plated with 11½-inch nickel steel, Harveyized, the port section being 12½ inches thick, each section weighing about 25 tons. The handling and setting of these plates is shown in Fig. 1, being swung by a chain attached to two eye screws in the upper edge of the plate, lifted and moved to its bearings by the large floating derrick, a part of which is shown at the right.

The method of fastening the turret armor is shown in Fig. 3, lower right hand corner. The fastenings are 18 bolts, 15 inches long, passing from the inside lining, two half inch plates, through a Georgia pine backing 10 inches thick and tapped 4 inches into the back of the armor plate.

Upon the inside, 3 inches from the heads of the bolts, there is to be another lining of ½ inch steel plates, not shown in the cut, for protecting the gunners from flying bolt heads by shots striking in line with the bolts.

The fitting of the plates and backing is a tedious and slow operation; templates having to be made for fitting the woodwork to the form of the plates, and other templates for laying out the bolt holes in the wood backing, which are then bored and trimmed radially, and so accurately that when the immense plate is brought to its bearing, the bolts freely enter from the inside.

The Salt Lake of Assal, Africa.

The French government has just sold to Mr. Chefneux the right to refine and export salt from Lake Assal, one of the most remarkable sheets of water in the world. The lake is in the district of Obock, East Africa, only a few miles from the head of the Bay of Tadjourah. The gentleman who has purchased the concession agrees to pay into the colonial office the sum of $10,000 a year, and if, during the fifty years that he is to have the exclusive right to export salt from Lake Assal, the annual product exceeds 50,000 tons, he is to pay a tax of 20 cents for every ton in excess. The government will designate a part of the lake where the natives may procure all the salt they want without tax or hindrance.

All along the edge of this little lake, which comprises only sixteen square miles, is a bed of nearly pure salt about a foot in thickness. The water of the lake is so surcharged with salt that it is impossible to sink in it. The bottom is apparently a bed of solid salt. The heavy waters lave the bases of jagged and precipitous mountains which descend to the edge of the lake, making it almost impossible to travel around it. Mr. Chefneux will probably carry on his work by floating machinery on the lake and dredging in the salt bed at its bottom, though on the west side of the lake an enormous quantity of salt is in sight when the lake is at its lowest level.

Very little was known about Lake Assal until seven years ago. The few men who had visited the lake were unable to tell whence it derived its water supply. The lake evidently had no outlet, and nobody was able to find a single stream flowing into it. The question was dismissed with the answer that the lake doubtless had subterranean affluents, and it was left for Mr. Henry Audon, seven years ago, to solve the mystery and prove that Lake Assal was indeed a very exceptional sheet of water.

Mr. Audon spent several days examining the shores, clambering with the greatest difficulty along the rim of the lake. He was about to give up the fruitless search when he heard the murmur of a little waterfall, and in a few minutes he stood on the edge of a large brook running into the lake. Much to his surprise, he found that the water of the brook was as salt as the ocean, and a little while after it was proved beyond a doubt that the ocean itself is the source of Lake Assal's water supply.

The lake is about 400 feet below the level of the sea. It is now known that three brooks from the Gubbet el Karab, a little land-locked bay at the extreme western end of the Bay of Tadjourah, conduct the waters of the Indian Ocean inland about ten miles to this remarkable depression. The salt, which the natives have gathered, perhaps for ages, along the edge of the lake, is carried to markets hundreds of miles inland.—*N. Y. Sun.*

A BOSTON lady has had a breakfast service of cups, saucers, and plates prepared for her large family, on which are given from photographs the likenesses of the members; so that the waiter can properly place the china to be used. Some one suggests that at any memorable dinner party the same complimentary process might be arranged for each expected guest, in lieu of dinner cards.

Decisions Relating to Patents.

ACTION FOR INFRINGEMENT.

The United States Circuit Court decides that where the right to manufacture and sell a certain patented improvement was dependent on the peformance of a condition contained in the agreement of transfer, the question of the breach of the condition must be first settled in favor of plaintiff before the federal courts can have jurisdiction of an action to recover damages for the unauthorized manufacture and sale of the articles. 1.

It is held by the Circuit Court of Appeals that when a patent has been assigned, together with all claims for past infringements, the fact that a person sued by the assignee has not sold any of the infringing articles since the assignment, and testifies that he intends to sell no more, is not sufficient to exclude equitable jurisdiction, when it appears that he still has them in stock, and has published a catalogue offering them for sale, and that in his answer he asserts a right to sell them. 2.

INJUNCTION.

The Circuit Court rules that a failure to prove actual infringement before the filing of the bill, as alleged, does not require the dismissal of the bill, or prevent a decree for an injunction and an accounting of profits and damages for infringements subsequent to the filing of the bill and before decree, if the bill also avers anticipated infringements, and prays for injunction and general relief; for the right to injunction rests entirely upon anticipated infringements, and the right to recover damages for infringement between the filing of the bill and the final injunction is incidental to the injunction, and necessary to make the remedy complete. 3.

The Circuit Court holds that the fact that a corporation owning letters patent upon a particular kind of machinery has entered into a combination with other manufacturers thereof to secure a monopoly in its manufacture and sale, and to that end has acquired all the rights of other manufacturers for the exclusive sale and manufacture of such machines under patents, will not entitle a stranger to the combination to enjoin the corporation from bringing any suits for infringement against him or his customers. 4.

In a suit for infringement it was stipulated that the patent was owned by complainant, "except the County of Knox, Ohio." The Circuit Court lays it down that even if this be taken to mean that there had been, not a license merely, but a complete assignment of the monopoly in Knox County, complainant still retained full title with that exception, and could sue for infringement elsewhere, without joining the assignee for Knox County as a party complainant. 5.

WHAT CONSTITUTES INFRINGEMENT.

Letters patent No. 336,385, issued February 16, 1886, to Charles Edward Chamberland, is for a filtering compound composed of pipe clay, or other suitable clay, diluted with water, and then mixed with porcelain earth or its equivalent, the latter being first baked and then reduced to a fine powder; the proportions being about 20 to 40 per cent of the clay to 60 to 80 of the earth. The Circuit Court decides, on motion for a preliminary injunction, that it was an infringement to use a compound of kaolin clay, or porcelain earth, and finely ground silex, in about the proportions of 30 to 45 per cent of the kaolin and the rest silex. 6.

A certain lever in defendant's watch movement could, when the works were out of the watch case, be adjusted to produce normal winding engagement, but in a stem-set watch, when the works are in the case, it is always held adjusted in such manner as to produce normal setting engagement. *Held* that such a construction, when used in stem-set watches, is to be regarded as operating on the principle of normal setting engagement, and as not different in that respect from the construction of the Church watch, letters patent No. 10,631, granted August 4, 1885, to Duane H. Church, for an improvement in stem-winding watches.

The court also rules that letters patent No. 10,631, granted August 4, 1885, to Duane H. Church, for an improvement in stem-winding watches, is infringed by watches made under the patent of January 3, 1888, to Thomas F. Sheridan, No. 376,015, and reissued August 5, 1890, No. 11,100; for, although there is a plain difference in the operation of the springs which produce the winding and hands-setting engagement in each watch, that difference is produced by a simple mechanical change, and the other differences arise from the use of mechanical equivalents. 7.

1. Routh *v.* Boyd, 51 Federal Reporter, 821.
2. Hanzel *v.* California Electrical Works, 51 Federal Reporter, 754.
3. Canton Steel Roof Co. *v.* Kanneberg, 51 Federal Reporter, 599.
4. Strait *v.* National Harrow Co., 51 Federal Reporter, 819.
5. Canton Steel Roof Co. *v.* Kanneberg, 51 Federal Reporter, 599.
6. Pasteur Chamberland Filter Co. *v.* Funk, 52 Federal Reporter, 146.
7. Illinois Watch Co. *v.* Robbins, 52 Federal Reporter, 215.

Correspondence.

Double Rear Wheels.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN for February 25, on page 122, "J." asks some questions about bicycles—"Why can't one be made with two rear wheels about 5 or 6 inches apart," etc. I would say to "J." that such a bicycle would be much more difficult to ride than the regular two-wheel safety, and any man too heavy or clumsy to ride an ordinary safety had better let such abortions as "J." wishes alone. I know of many men over sixty and heavy, up to 210 pounds, who find no difficulty in riding a safety. The writer is a heavy weight, not at all agile, and much on the shady side of 50, and having tried in past to ride narrow gauge three-wheelers speaks from sad experience. A. G.

Appleton, Wis., February 25, 1893.

A Flattering Note.

To the Editor of the Scientific American:

I wish to tell you there is no paper printed that equals the SCIENTIFIC AMERICAN, and by reading and looking at the clever cuts which it contains for the last fifteen years, I have been able to make and place on the door of my residence a brass plate, which contains the house number and my name, and a plate which covers the opening, which is a mail box, and by placing the mail against the plate which contains my name, an electric bell rings in the kitchen until the mail drops from the door on the inside of the house. It is impossible to get a small calling card through without ringing the bell in the kitchen. So you can imagine, if you have not seen it, a mail box, a number, a name plate, a letter box and a door bell all in one piece. I put it on the door January 25, and it has worked to perfection. I also made an electric alarm work to perfection. The common eight-day clock is downstairs and the bell is upstairs in my bedroom. By turning a small wheel on the face of the clock at any hour, or even minute, the bell will ring in the morning until I get up and shut the bell off. These two inventions I wish to thank the SCIENTIFIC AMERICAN for. Let a person take the SCIENTIFIC AMERICAN one year, and if he is not able to make some kind of an invention, he is very thickheaded. This year I am taking both papers, and I get the subscription price of a whole year every paper I read. I would like to see the SCIENTIFIC AMERICAN in every family.

Clinton, Iowa. G. P. YULE.

Signaling Mars.

To the Editor of the Scientific American:

In all the projects for signaling Mars proposed by learned Thebans, I have seen no reference to what seems to the unlearned layman the most self-evident difficulty.

It is that the bright side of Mars is always toward us. If signals were sent at night from the dark side of our globe by artificial light, the flashes would have to be of such intensity that they could be seen through sunlight of that planet. To effect this they would have to be intensely bright. If they could be seen, would the observers know from whence the signals came? Unless their powers of vision are different from our own, they could not see our planet in their daylight. Then much less could they see flashes of artificial light sent from it.

Sunlight flashes from a combination of mirrors would have to be sent in the wrong direction. Mars is often in our range of vision in the daytime; but is lost in the brighter sunlight. At rare intervals the planet Venus can be seen by day. Flashes from mirrors might at such times be sent to it. Such flashes would fall on its dark side and would be seen, if at all, by its inhabitants in their night time.

Yet we hear of no proposition to telegraph that planet, which is as large as our own, and as likely to be inhabited by intelligent beings as our much smaller back-door neighbor. T. M. ANDERSON, *Col. U.S.A.*

Vancouver Barracks, February 25, 1893.

Aeronautical Congress at the Columbian Exposition.

A congress devoted to the discussion of aerial navigation is to be held at the World's Fair at Chicago. The objects are stated to be the discussion of the problems involved in aerial navigation, the collation of the latest results and researches, and the interchange of ideas and effecting of a concert of action among the students of the subject. The work of Langley and of Maxim has given the subject a new impetus in the last two years, and the congress will, therefore, be held under peculiarly favorable auspices. The afternoons of Tuesday, Wednesday, and Thursday, August 1, 2, and 3, 1893, have been assigned the conference. The opening session will open at 2:30 P. M., August 1, in one of the halls of the World's Congress Art Palace. For cards of admission, list of topics, and other information the secretary of the organizing committee, Prof. A. F. Zahm, Notre Dame, Ind., should be addressed. The list of committee members shows a selection of well known representatives of science and professional life.

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RECREATIONS IN PHOTOGRAPHY.

We are glad to see that the directions that we have on several occasions given as to the use of a black background have been put to profit by our readers. We have just received from Mr. R. Riccart, of Sainte-Foix-les-Lyon, a series of very interesting photographs from which we select the specimens herewith reproduced, and which appear to us to be of an original composition. The system employed by the author of these photographs is that of the natural black background obtained through the open door of a dark room, combined with diaphragms skillfully arranged in the interior of the apparatus, between the objective and sensitized plate. This is the surest method of obtaining the desired effect with the greatest precision, without the junctions being visible, and with perfect clearness for the section of the parts removed. To this effect, it is necessary to place the diaphragm at three or four centimeters from the ground glass, in the last folds of the bellows of the camera.

The following are a few data as to the manner in which the scenes that we reproduce were obtained. The first, representing a decapitation by means of a saber (Fig. 1), was taken by means of an exposure in which the head was placed upon the block, the subject inclining forward upon his knees, and a diaphragm, occupying about two-thirds of the plate, completely masking the body up to the neck. Then, without changing the position of the apparatus, the diaphragm was placed on the other side in order to conceal the head, and the body was photographed in the second position along with the person representing the executioner. It would have been possible, by a third exposure, to so arrange things as to make the executioner the decapitated person. It was by the same process that the three following scenes were obtained: A person with his head placed before him in a plate (Fig. 2); a man carrying his head in a wheelbarrow (Fig. 3); and a person to whom his own head is served in a plate (Fig. 4). Such scenes may be varied to infinity. Fig. 5 gives an amusing specimen. We have seen an unfortunate victim placed upon a sawbuck, and whose head has been sawed off and lies upon a block.

Fig. 6 gives the same individual photographed twice, on two different scales. This sort of reproduction gives us an idea of the position that we shall have to take when we are called upon to consider our bronze in Colas reduction. An idea that appears to us very original is that of the person in a bottle (Fig. 7). The individual represented was first photographed on a sufficiently reduced scale to allow him to enter the bottle. This exposure was made by arranging a diaphragm around the subject, that is to say, by using a screen containing an aperture, as for the Russian background. But this precaution was taken merely to conceal the floor, and yet it would perhaps be preferable in such a case to have the subject stand upon a stool covered with a very black fabric. However this may be, when once the first impression has been made, there is nothing more to be done than to photograph the bottle on a large scale and the result is obtained.—*La Nature.*

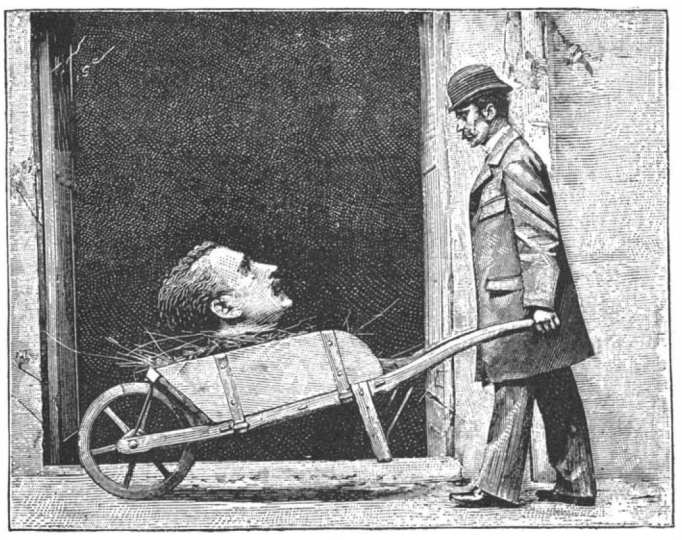

Fig. 3.—THE HEAD IN THE WHEELBARROW.

Fig. 1.—A DECAPITATION.

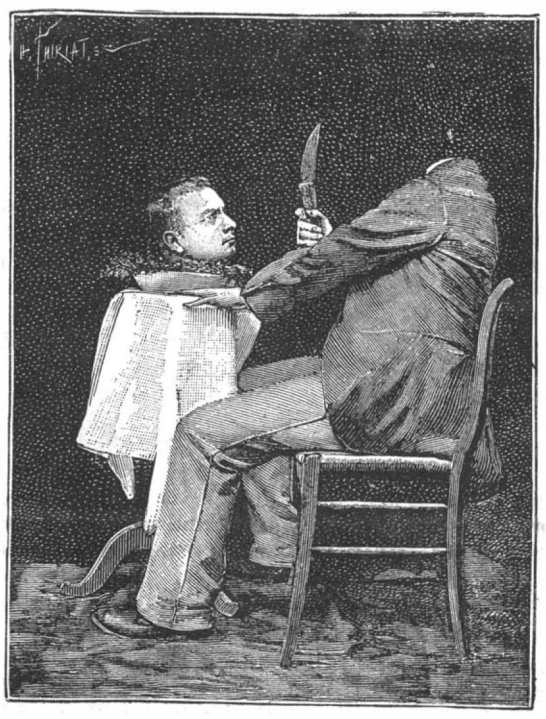

Fig. 2.—ANOTHER DECAPITATION.

Fig. 4.—THE HEAD UPON A PLATE.

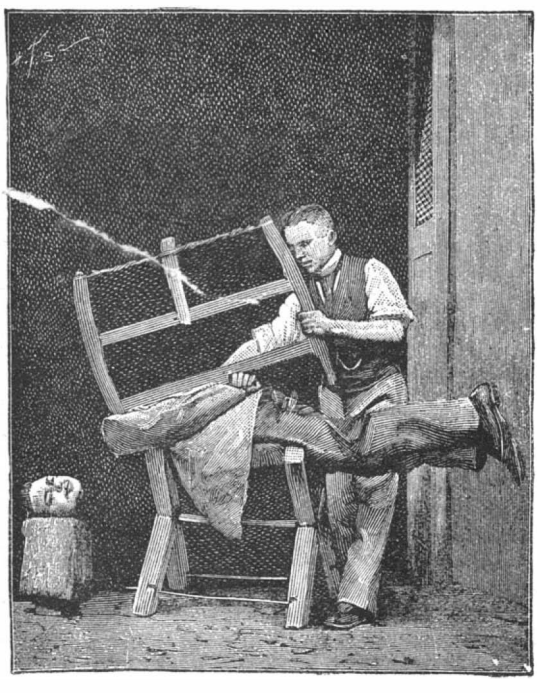

Fig. 5.—THE SAWED-OFF HEAD.

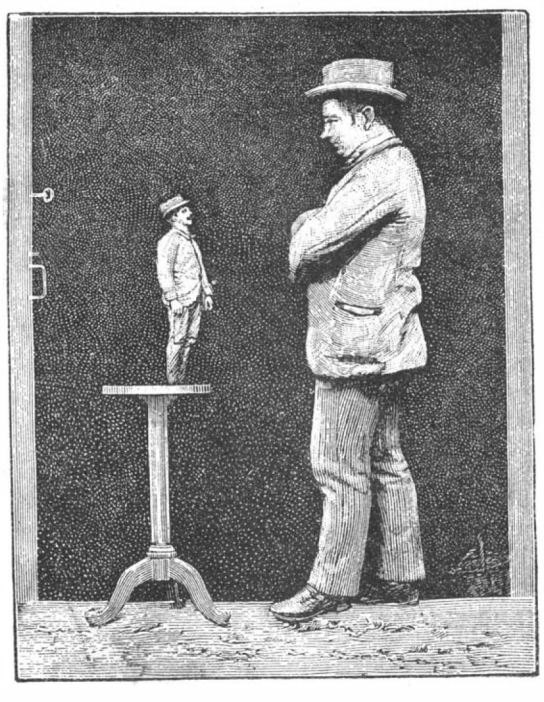

Fig. 6.—THE REDUCTION.

Fig. 7.—MAN IN A BOTTLE.

Delftware.

Of the many ornaments that adorn our houses, few are more beautiful than the specimens of Delft pottery some are fortunate enough to possess. A few details as to the date of its origin and other particulars from the *Pottery Gazette* will not be without interest. One of the best authorities places the date of the first manufacture of delft between 1596 and 1611. During the first forty years or so, plates and other objects representing a number of personages, battles, "kermesses" or fairs, religious or mythological scenes, abounded. In the second half of the seventeenth century this pottery attained its highest degree of perfection. From this period date the lovely views and portraits that made its fame. An artist named Keiser was the first to imitate in this ware Japanese porcelain, also that of India and China. Then appeared lovely groups of flowers and animals. At this time also were employed the beautiful blue, red, and gold tints that became the rage, and at the end of this same century Louwys Fictor held a prominent place on account of his designs, showing garlands and hangings, imitated from Eastern artists. In the eighteenth century this manufacture began gradually to lose its artistic stamp, and tended to become purely industrial. Little by little the furnaces were closed, and instead of the thirty establishments formerly dedicated to the manufacture of this ware, and which made the reputation of the ceramists of Delft, only one exists at the present day, while its products cannot in any sense bear comparison with those of an earlier date.

INVENTION is only beginning to receive something like just appreciation at the hands of intelligent women. It has been the greatest of all helpers in the advancement of women, in placing each successive generation on a higher plane.—*Inventive Age.*

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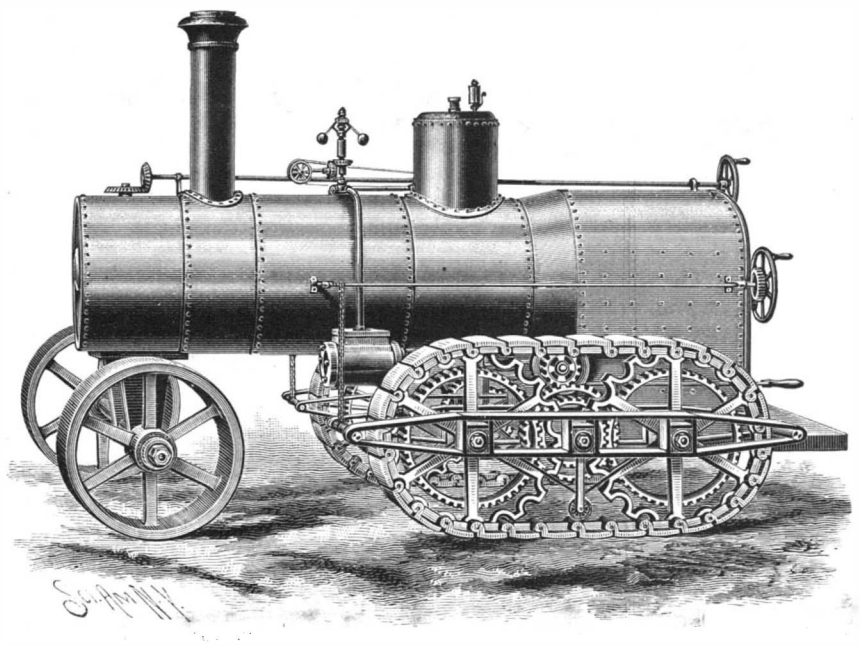
AN IMPROVED TRACTION ENGINE.

This machine is more especially designed for use on farm land, to travel readily over plowed ground, for cross plowing and other work, and is propelled by endless tracks which travel on the ground and are engaged by wheels actuated from the engine. The improvement has been patented by Mr. Charles H. Stratton, of Moscow, Pa. In front of the usual boiler and smoke box is a cold water tank, and the front end of the machine is supported by wheels upon a pivoted axle, the wheels being turned as desired for steering purposes by means of a bevel gear connection with a rearwardly extending rod actuated by a hand wheel. The rear part of the frame is supported by tracks in the form of endless chains, a rib or web across the inner side of the track sections affording a straight surface for friction rollers to work upon when the driving wheels meet with obstructions causing too great strain. The inside of each link of the tracks is segmental, and their outer surfaces have corrugations or ridges which readily embed themselves in the ground. The axles of the track-carrying wheels, and of a central shaft carrying gear wheels, are journaled in a frame adapted to oscillate to conform to any inequalities of the surface of the ground, and, to facilitate turning, the forward end of the frame may be raised by a rod and chain, the rod extending back to the platform and being operated by a hand wheel. The central shaft, by means of gears and pinions, is actuated from the engine, and communicates motion to the track-carrying wheels, whereby the machine may be propelled backward or forward, the pinions being thrown into and out of gear by a lever extending to the back platform. This machine has far greater traction surface than other machines of the kind, enabling it to travel on the softest of ground. Its track is 12 inches wide and 3 feet 6 inches long, thus affording a surface contact of 500 inches. By means of a bevel gear wheel on the crank shaft, the machine actuates a shaft, not shown in the view, but which may be utilized to drive thrashing, mowing or reaping machines, or for any other purpose for which power may be needed.



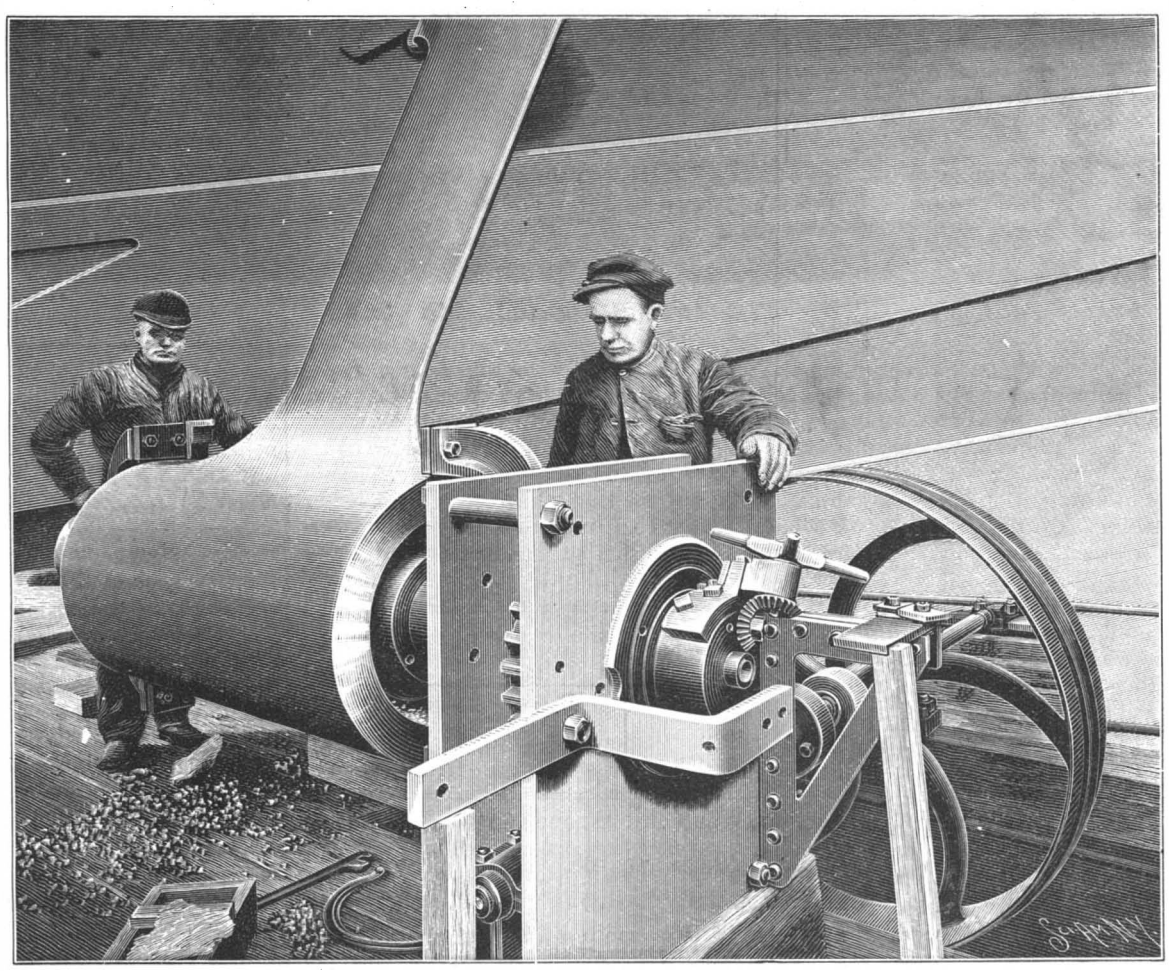
STRATTON'S TRACTION ENGINE.

PROGRESS OF THE CRUISER MAINE.

The alignment of the outboard bearing of the twin propeller shafts on vessels of the dimensions of our armored cruisers requires to be done after the bracket is in place; owing to the fact that the bracket has to be flanged and riveted to the hull, which under the quarter has a varying surface, which makes it very difficult to fit the brackets with a precision of alignment necessary to so important a work, as the brackets have to be flanged and riveted to the steel plates of the hull. To make the alignment perfect, the bearing in the bracket head is roughly bored somewhat smaller than the finished size, and when the bracket is made fast as nearly as possible in its proper place, the boring machine we illustrate is attached to the head of the bracket, adjusted in the exact line of the shaft, and the hole bored to its proper alignment.

Our engraving illustrates the mechanism and mode of boring one of the brackets of the war ship Maine, which is now being completed at the navy yard, Brooklyn, N. Y. The machine, as represented, was designed and built at the Quintard Iron Works, they being the builders of the engines and propellers of the cruiser Maine. As will be seen by inspecting the illustration, the boring bar is made hollow, to facilitate alignment.

The cutter is moved forward on the bar by a screw driven through the bevel gear seen at the rear end, turned by the spoke wheel striking the brackets at each half turn of the bar, the power being derived from a portable engine below the platform, running by steam from a donkey boiler on board of the ship.



BORING THE BRACKET STAYS, OR OUTBOARD SHAFT BEARINGS, ON THE ARMORED CRUISER MAINE.

For facing the shaft bearing a radial cutter arm was clamped upon the cutter bar, holding the cutter and fed by a radial screw and spoke wheel. This machine is but one of the ever-varying novelties constantly coming into use to suit every contingency found in making and perfecting the new forms and conditions made necessary by the ever-changing types and sizes of the great motive power machinery now being made. The Maine ranks as an armored cruiser of the first class. Her keel was laid October 11, 1888, at the Brooklyn navy yard, and she was launched November 18, 1890. Built of steel throughout. Dimensions: 324 feet length, beam 57 feet, draught 21 feet, 6 inches; displacement, 6,682 tons. Speed, 17 knots. Protective armor 180 feet long, 12 inches thick, of nickel steel. Two armored turrets. Engines, 9,000 horse power. She will carry a most formidable armament. Estimated cost, $2,500,000.

Copper on Prints.

That the salts of copper increase the resistance of coloring matters to the action of light has been known for some time, and the results of experiments with precipitated copper, the oxide, the sulphide, the sulphate, and the acetate of the metal, were communicated by M. Camille Schoen to the Mulhouse Society last year. These experiments proved that all these salts exercised the same protective action, whereas the ferrocyanide had no such effect. M. Schoen sends a further note on this subject to the society in which he records that these salts determine the formation of oxycellulose on the white parts of the fabric, but this production of oxycellulose is very feeble, except when a salt of ammonia is present. A white fabric printed with a salt of copper (the ferrocyanide excepted), mixed with a salt of ammonia and exposed to the sunlight, undergoes considerable change in the printed part as a consequence of the production of oxycellulose, but in printing with the same mixture on dyed cloth the color produced is protected and there is no alteration in the fiber. It is probable, then, that copper exercises its protective action on coloring matters by reoxidization. The salts of iron, tin, and manganese with or without the addition of an ammoniacal salt have no protective effect, says M. Schoen, noting at same time that Persoz, in his work on coloring matters, speaks of the protective action of oxide of tin on a vat blue exposed to the sun. Chloride of vanadium has analogous action to that of a salt of copper, but the effect is less strongly marked. Prud'homme has noted the oxidizing action on an ammoniacal solution of copper. It is possible that in the presence of the light there is a decomposition of the ammoniacal salt on the tissue and the formation of ammonide of copper.

Temperature North and South.

The lowest mean temperature that occurs anywhere, or at any season on the globe, occurs in January at Werkojansk, in northeastern Siberia. Here the mean for the first month in the year is —61·2°. For the same period the temperature is —40° over the region situated a little north of the magnetic pole. At Werkojansk, the thermometer has registered over 88° below zero.

Going to the other extreme, the atmosphere of the Colorado River desert has shown a maximum of 120°, and this will give a seasonal variation over the land of upward of 200° Fah., against less than one-third of that range over the water of the Atlantic. The comparative constancy of oceanic temperatures moderates the climatological conditions of approximate land masses very considerably, and the disparity between summer's heat and winter's cold is still less marked when the seaboard is swept by warm ocean currents. The mean annual temperature of the British Islands is quite 20° higher than it would be did its temperature depend upon latitude alone. This is, of course, owing to the influence of the Gulf Stream, which is calculated to pour into the North Atlantic some 38 cubic miles of warm water per hour. The heating effect of this current upon the atmosphere of the North Atlantic is best seen by comparing the position of isothermal lines with the same temperature lines in the South Atlantic. Thus, in the month of January, the isotherm of 35° runs in almost a straight line from Boston to Iceland and from Iceland across to the Norwegian coast. At its most northerly limit it just impinges upon the Arctic circle. Thus, the mean temperature of 35° is found in the coldest month at a distance of 66½° north of the equator. In the South Atlantic during the month of July, the midwinter month, the isotherm of 35° is practically identical with the 50th parallel of latitude. Contrasting the temperatures for the midsummer months, it will be seen that while in the South Atlantic the isotherm of 50° has a mean latitude of 45°, the same isotherm in the North Atlantic passes over the middle of Iceland, and from there runs in a straight line to the North Cape of Norway in latitude 72°.—*Nautical Magazine.*

THE next meeting of the American Association for the Advancement of Science will be held at Madison, Wis., in August, 1893. It is to take place within easy distance of Chicago, during the season selected for the various scientific congresses of the Columbian Exposition. The meeting will doubtless be attended by many men of science from abroad. It is desired to make the Madison meeting a success in the matter of attendance, and more particularly as to the character of the papers presented.

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THE UTILIZATION OF OLD TIN CANS.

In the suburbs of great cities an industry has sprung up, having for its object the recovery of the solder used in making and sealing tin cans. In consequence the formerly despised and useless tin can has acquired sufficient commercial value to rescue it from the back lot dumping ground and garbage scow.

Uner the present system of street cleaning, New York City's refuse is loaded on scows from docks located at convenient intervals along the river front, and then taken to sea and dumped. These docks have double decks, the upper projecting sufficiently to allow the contents of a cart to fall upon the middle of the scow, and be distributed by the trimmers who keep the vessel on an even keel. The trimmers also select everything of value with the greatest care; rags, fat, bone, metal, paper stock, etc., being stored on the lower deck of the dock. The silver and jewelry form no small item of the contractors' profit, and the total value of a scow load is estimated at an average of two hundred dollars.

The space between the dock platforms is often closed in with odds and ends, and the interior converted into a miserable habitation by the trimmers, men and women, who thus herd together, their supplies being drawn from the dump.

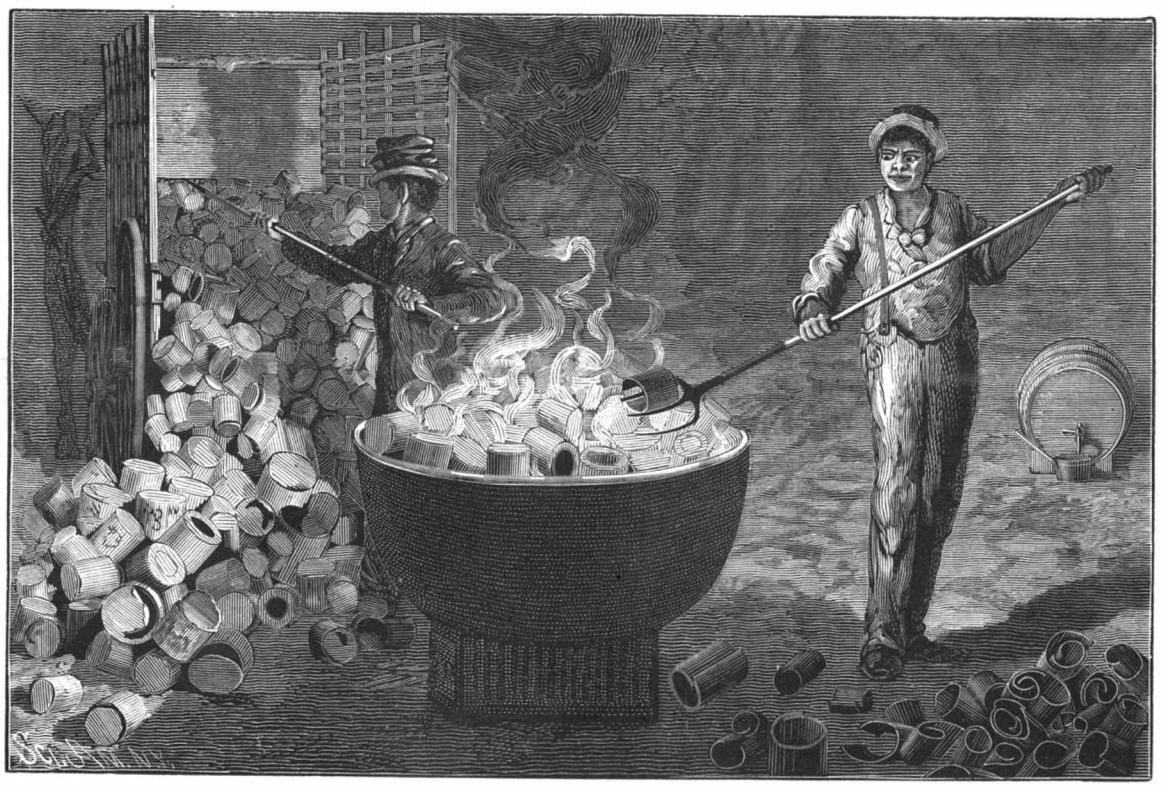
These dumping docks are the principal source of supply for the industry we illustrate, and a wagon load of tin cans can be bought at such places for four or five dollars.

The furnace is an old soap boiler, into which a few sticks are thrown; the bowl is then filled with cans, a quart of kerosene poured over them and ignited.

The heat developed by the oil is not great enough to attack the tin, but melts the solder, which flows to the bottom of the bowl. The solder recovered from a load of cans averages forty pounds. After this process is completed the tin plate scrap is sold to make what is called "acid."

Into a large open vat containing waste acid, acid ferric sulphate, sulphuric or hydrochloric acid, the scrap is thrown and allowed to remain until the tin is stripped from the iron underneath; more scrap and metallic iron is added until the solution is neutral. The tin thus dissolved is used as a basis for the preparation of stannates or other tin compounds, and by dyers.

The iron plate is rolled into balls for melting, the ferrous sulphate purified and sold as commercial copperas, and the remaining acid used in repetition of the process.



THE UTILIZATION OF OLD TIN CANS.

Chemical Notes.

At the last meeting of the Manchester section of the Society of Chemical Industry, Dr. Carl Otto Weber read three short papers. The first touched upon "The danger attending the presence of ammonium nitrate in nitro-cellulose." He described an explosion which had occurred when he was preparing a small quantity of di-nitro-cellulose. In order to obviate washing out the last traces of acid, he had used a dilute solution of ammonium hydrate for the last washing. On drying the nitro-cellulose at about 70° C., a violent explosion occurred.

He had observed on a previous occasion that a mixture of ammonium nitrate and acetic acid, when evaporated, subsequently ignited with almost explosive violence, and he deduced from the experiments which he had made that the presence of small quantities of ammonium nitrate in such bodies was a source of considerable danger.

The second paper referred to the dyeing of woolen goods in copper vessels. He mentioned that the action of alkalies and acids in such vessels often affected the shades of the dyes in a prejudicial manner. To overcome this difficulty he instanced the use of strips of zinc on the Continent, which, with the copper, formed an electric couple, the zinc passing into solution instead of the copper.

The third paper was on the oxidation of cotton in bleaching and cop dyeing, which led to a somewhat chatty discussion between Dr. Schunk, Messrs. Terrey, Crippin, Levinstein, and Dr. Weber, during which the chairman, referring to the former paper, pointed out that the presence of zinc salts might be as objectionable as salts of copper, and also that the hydrogen gas evolved might form an objectionable element in some cases. The discussion turning to the conveyance of corrosive liquids in dye and other works, Mr. Levinstein mentioned, for the benefit of the members, that he had overcome the difficulty formerly experienced in transporting nitric acid about his works by using the glass-lined tubes made by a firm at Barnsley (Messrs. Dan Rylands, Limited), the adoption of which had, in his case, been attended with highly satisfactory results.

Fire Service of New York City.

The present fire department is organized in companies of 12 men each, including a foreman, assistant foreman, and two engineers. A truck company has the same number of men and officers without the engineers. These companies are formed into battalions to the number of 12, each battalion consisting of 5 to 10 companies, and being in charge of a chief. These 12 battalions are again divided into two divisions, each division being under the immediate supervision of a deputy chief, and the whole under the direction of the chief of the department.

The engine companies are equipped with a steam fire engine, drawn either by one or two horses, according to the size of the engine, its weight varying from 5,500 to 9,500 pounds. On some of the heavier engines three horses are used. The truck companies are supplied with ladders which reach to a height of from 16 to 85 feet. They carry all the modern appliances used in putting out fires, such as tin cutters, hooks, cellar pipes, and other implements which are likely to be of help.

Each fire company is assigned by a regular order to respond to fire alarms in certain localities, on the first, second, third, fourth, and fifth alarms, and in special calls if necessary. So that every company when called knows exactly by the signal where to respond and report for duty. This they do at the signal box nearest the fire.

The first alarm covers a territory about a mile square; the second, two miles; the third, three, and so on, the territory growing wider at each alarm. The calls, regularly numbered, are printed in a book, a copy of which is at the central fire station, and also in the possession of each engine house in the city. For instance, we will suppose that the call is "485." The book will show what companies are to respond. The record in the book in this particular case appears as follows:

485	Engine Companies.	Hook and Ladder Companies.	Chiefs of Battalions.
3d Avenue and 40th Street.	21, 8, 16, 25, 1, 54, 54, 39, 14, 2, 5.	2, 7, 4.	8, 9, 6, 7.

Station 485 is at Third Avenue and 40th Street; engine 21 is just around the corner; engine 8 is at 50th Street. Those are the two nearest companies, and they respond to the first alarm. In case the fire is a large one, there is a second alarm, which brings out three engines, one truck, another chief of battalion, a deputy chief, and the chief of the fire department. A third alarm brings five engines and another chief. When the fire is a very large one, the signal called the "two nines" is sent out, which means that all the companies due on the third alarm at that particular station shall report there.

In fighting a fire, the first object of the chief in charge of the firemen is to ascertain the locality and extent of the conflagration. Sometimes he does this by sending one or more messengers into the building; but generally, in order to make sure of the matter, he makes the investigation himself. He is then obliged to make up his mind on the spot as to the best positions from which to attack the fire, and assigns his men accordingly. Sometimes he is successful in the plan he has laid out, while often he is compelled to abandon it. This change is made necessary on account of the combustible material in the building, which throws out such an intense heat that the men cannot remain at the original points decided upon. At other times he is successful in forcing an entrance into the building, in which case he is generally able to extinguish the fire.

Fires are strange things to handle; they have a certain individuality. Each fire burns in a different way, and it requires a technical knowledge and long experience as a fireman before a man is able to form even an approximate judgment as to the cause of a fire and the best way of putting it out. The decision must be made instantaneously. There is no time for thoughtful deliberation or consultation. You must judge of the surroundings, the size and character of the building, the material that is inside of it, and the possibility of the extension of the fire under certain emergencies. When the fire breaks loose from the building in a seemingly furious effort to escape from its confinement, then you must be ready to meet it and prevent its extension to adjoining buildings, or possibly across the street.

All these conditions are such that no man can possibly foresee them, and therefore no general plan can be laid down for putting out a fire, because, as I say, each one burns differently.

A man entering the fire department of New York is appointed under the civil service rules for the probationary term of 30 days. He is sent to what we call our school of instruction, where he is taught the use of the different apparatus, the scaling ladders, the life lines, and the tools and implements used in the department. His days are devoted to the school, his nights to service in the department where he has been assigned. At the expiration of the probationary term, if he is recommended by his commanding officer for actual fire duty, and also by the instructor of the school, he is regularly appointed a fireman, but after his appointment continues his instruction for 30 days more. He is required to become perfect in the use of the scaling ladder, life lines, belts, etc., and to display an ambition to become a proficient worker. He is taught to lower people from the roof, to raise ladders up to windows to the height of 90 feet, etc.

After a man has attended the school of instruction for 30 days he is assigned to a company. After the first year's service at $1,000, if he proves himself efficient, he will be advanced to the second grade, which gives him $100 a year additional salary. He is always on his good behavior, and even one charge of improper conduct of any kind will prevent his promotion in the ranks.—*Hugh Bonner, Boston Globe.*

Tempering Large Armor Plates.

A new process of tempering a 14 inch Harveyizing armor plate was tested in Bethlehem, Pa., recently. Heretofore this was done by ejecting ice water against a red hot plate in a vertical position, with the result that the water was made boiling the instant it touched the upper end of the plate, and the heated water running down did not have the proper effect on the rest of the plate. In the new process the plate was laid down in a specially prepared frame; the water was made ice cold by treating it with salt, and was then led to a large sprinkler lowered within one foot of the plate. The water was forced through the sprinkler under great pressure, while the under side of the sprinkler was kept cool by water running over it from a fixed spigot. The sprinkling continued for 1½ hours, and the plate was then taken by a crane and immersed in the oil baths, there to remain 30 hours. The government officers present regarded the new process as highly successful.—*Manufacturers' Gazette.*

New Invention Wanted.

Electric gutter for melting snow and ice, in towns and cities, to prevent accumulations, such as now are impeding travel, and costing more to remove by cartage, etc., than would pay for electric gutters, if economically constructed.—IDEALIST.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Alexis F. Gillet, Kearney, Neb. This engine is preferably constructed with two steam chambers, with pistons arranged to operate alternately, and the abutment or slide valve is formed with two apertures, and operated for variable movements by the piston, the valve alternately connecting the main chamber with the steam inlet to drive the piston and the valve pocket to cushion the valve. It has a solid base portion and channel way connected therewith, providing for a sufficient steam abutment to hold the valve against the piston. The engine is constructed of few parts, and the piston travel and abutment movement are regular, the usual jarring and thumping being avoided.

ROAD WAGON.—Clarence Gillett, Gloversville, N. Y. This invention relates to traction engines propelled by steam, compressed air, electricity, etc., providing a simple and durable road wagon, adapted to carry passengers or freight, and to be propelled at a high rate of speed and easily steered as desired. The boiler is preferably of the Shipman style, to utilize oil as a fuel for generating steam, and the wheels are so mounted that they will readily pass over any obstructions in the road.

FURNACE TO TREAT ORES.—Charles J. Fauvel, London, England. This is a furnace for the treatment of refractory ores containing precious and other metals, and is one in which the oxidizing of the impurities is effected by a current of hot air entirely out of contact with the furnace gases, so that the ore will be delivered in what is known as a "sweet" condition. The furnace is so constructed that the oxidizing current is separately heated, and the passages are so arranged that neither the ore nor the oxidizing current can at any time come in contact with the products of combustion of the fuel, while the flues for the latter are designed to secure its utilization to the utmost extent. The furnace is also applicable for utilizing the silver in the ore by adding the chlorinating medium.

Railway Appliances.

CAR COUPLING.—George W. Mahan, Cold Spring Harbor, N. Y. This is an automatic coupler of strong, simple, and durable construction, which embodies the principle of the old-fashioned link and pin coupling, and is so constructed that the pin by its weight will hold the link in position to enter an opposing coupling. The device may be operated to uncouple from either the top or the sides of the car, so that the brakeman need not go between the cars to uncouple them.

RAILWAY BLOCK SIGNAL.—Frank B. Burt, New York City. This invention provides a simple mechanism for the expeditious and positive operation of a block signal system, in which the signal will remain set in the block while the train is in the block, but when the train leaves the block, in setting the signal of the block it enters, the signal of the block it leaves is taken down or concealed. The mechanism of the system is brought into action by a trip mechanism carried by a car or by the engine, and at each block it is connected with the signal of that block and the signal of the block in advance.

CLAMP.—Walter Hewitt Robinson, St. Paul, Minn. This is an improvement on a formerly patented invention of the same inventor, for a clamp which can be readily applied and manipulated for conveniently removing or replacing the cap and spring in air-brake cylinders. The construction of the clamp is strong and simple.

RAILROAD CONSTRUCTION.—Eliphalet L. Arnold, Georgetown, Texas. This invention provides for building an all-metallic railroad, to be strong, not very expensive, and which can be rapidly laid. The cross ties are essentially triangular in cross section, are hollow, to be filled with ballasting material, and each has a horizontal cross brace near the top serving as a support for rail-supporting chairs. The tie has a dovetailed recess to receive the rail-supporting chairs or wedges, by which the track rails are held firmly on both sides throughout their entire length, so that if a rail should break at any point it would still be held in place, and there is no chance for the rail joints to settle. Thus a perfectly smooth road may be made.

Mechanical.

LOOM LET-OFF MECHANISM.—Jeremiah C. Bill, Willimantic, Conn. This is a very sensitive and automatic mechanism, whereby, as soon as the slightest pull is exerted upon the warp, friction disks are so moved that the warp beam is turned a sufficient distance to let off the warp required by the working of the loom. An arm mounted to swing, and controlled from the warp beam, is connected with a friction disk adapted to engage a second friction disk geared with the warp beam and driven from the operating mechanism of the loom.

QUILL WINDER.—Corry Jones, Long Island City, N. Y. This winder has a frame to be secured to the loom or other machine, and on the frame is journaled a hollow slotted spindle provided with a disk and a fast and loose pulley, a traveler actuated from the spindle having a slot and a thread guide, while a vertically movable rod actuated by the rise of the quill has an arm on its lower end in the upward path of which is a pivoted brake arm, a belt shifter being loosely engaged by the brake arm. The device is very effective and positive in operation, and not liable to get out of order.

WRENCH.—Walfrid A. Aberg, New Westminster, Canada. This is a strong and simple wrench arranged to permit of moving the jaws into any desired angle relative to the handle, so as to turn nuts in close quarters. It has a swinging head having a polygonal head at its axis, an outwardly swinging locking arm being pivoted to the handle at right angles to the axis of the wrench head, and having a polygonal opening at one end to receive the polygonal head and lock it, there being also means for locking the swinging arm in place.

TILE MACHINE AND CUTTER.—John Fernald, Wellington, Ill. This is a simple and strongly constructed machine for quickly and accurately producing pipes or tiles of different sizes, from clay or composition of like consistency. The larger pipes or tiles may be delivered vertically, while the smaller ones leave the mill in a horizontal position, the pipe or tile being automatically cut off in required lengths from a continuous bar or cylinder coming out from the formers.

CONCENTRATOR.—Joseph A. Coombes, London, England. An improved hand power device, for conveniently and thoroughly separating gold from gravel and alluvial beds, is afforded by this invention, it being also designed to save precious metals from pulverized quartz and tailings without the aid of water, quicksilver, or chemicals. The gravel or other material to be treated is placed in a hopper, from which it is passed over a series of sieves, and thence into a hopper where it is subjected to a draught caused by an exhaust fan, the arrangement being such that the currents of air are broken up and eddies are produced to facilitate the collecting of fine float gold.

CAM FOR STAMP MILLS.—George A. Thompson, Tombstone, Arizona Ter. This is a cam for lifting the stamps, and is made in sections for conveniently fastening it on the shaft or removing it without disturbing the other cams or parts on the shaft. The cam comprises two interlocking toothed sections, each provided with a hub portion, a sectional band engaging the hub portions being provided with lugs for the reception of bolts.

TIMBER MORTISING MACHINE.—Charles P. Turner, Johnstown, Pa. This machine is especially designed for producing mortises in large timbers or in heavy beams, and its construction is such that vertical or horizontally placed augers or boring tools may be brought into action as may be desired, the cutters being also capable of removing material between the adjacent bores or apertures made in the timber or beam. The entire machine is portable, and may be placed upon beams or upon a table.

LATHE CENTER.—William C. Roe, Honolulu, Hawaii. An outer center engaging the work to be turned is mounted to turn on an inner fixed or dead center, the latter having the usual shank adapted to engage the tail stock or the main head stock spindle in case the device is used as a live center. The device may be quickly applied and arranged to be conveniently adjusted to bring irregular work into a true position for turning it correctly.

WEIGHT MOTOR.—John G. Ball, Chesterville, Ohio. This motor is more especially designed for actuating pumps, operating for a certain predetermined time and then stopping automatically. It consists of a lever connected at one end with the machinery to be driven and at its other end pivoted to a pitman connected with a crank arm attached to a shaft belonging to a train of gear wheels connected with a drum on which winds a rope carrying a weight.

Agricultural.

PLOW.—Charles H. Gerrard, Xenia, Ill. The beam, the shank, and the handles of this plow are so constructed that shares of different kinds, adapted to be used upon soils of a wide variety of character, may be quickly and conveniently attached to the beam and shank. The plow is very simple, strong, and inexpensive, and its colter may be easily removed, or it can without trouble be carried upward out of the way. The invention comprises various novel features of construction and combination of parts.

CULTIVATOR.—Bluford T. Scott, Milford, Ill. This invention provides in one implement a combination of gopher blades and shovels, to first stir the ground with the shovels and then level it by means of the gopher blades. The shovels are kept away from the plants, but the blades run closer, so as not to endanger the roots, and from the manner of connecting the braces or adjusting bars of the blades, the outer end of the blade is always the lowest, so that it can run close to young plants without injury. The blades are reversible, and may be adjusted to allow the operator to throw the soil to or from the plants as he may desire.

PLANTER AND CULTIVATOR.—John B. Burke and John F. Badger, Quitman, Ga. This invention relates to grain-sowing cultivators, and provides a machine that is easy to adjust and operate, not costly to build, and designed to be very durable. The plow may be of the ordinary construction, with a clevis in front to be connected with the draught chain or doubletree, but the plow can readily be held at any desired height, or drawn up out of engagement with the ground during the travel of the machine from one part of the field to the other. In a hopper-shaped seed box secured to the beam of the main frame is journaled a stirrer wheel, but the stirrer is removed and a dropping disk inserted for planting corn, an opening plow being then placed in advance of the seed dropper and a coverer plow at its rear.

Miscellaneous.

BREECH-LOADING SHOT GUN.—Charles F. Hacker, Parsons, Kansas. This improvement is designed to afford greater simplicity, strength, and durability in the construction of locks, ejectors, and fore ends, together with a more perfect balance of the gun itself, and with greater safety in a hammerless gun. Combined with an annular hammer is a stationary hub or cylinder arranged within the hammer, and a coil spring arranged within the cylinder, while the gun barrels have independent ejectors, and a separate spring mechanism for throwing out the ejectors, push pins being connected with the spring mechanism and operated upon by the hammers to put the springs under tension to independently throw out the shells.

AXLE LUBRICATOR.—John W. Schoaf, McKeesport, Pa. The wheel hub has, according to this invention, an oil chamber surrounding its central tubular portion, the oil inlet being at one end of the hub and its outlet at the other end, which moves next to the contact surface. This outlet is closed by a spring-pressed ball valve, adapted to turn or roll as it abuts against the contact surface, and when not so engaged being held closed by the spring. The invention is likewise applicable to pulleys and analogous devices.

SASH FASTENER.—Robert D. Murphy, Baltimore, Md. This is an improved article of manufacture in which the fastener and lock consists of a disk with roughened exterior and eccentrically pivoted, oppositely projecting twin hooks having a shank pivoted to the disk. The device is very simple, and may be applied either to the sash or to the casing, holding the sash in any position in which it may be placed or locking it closed.

DOOR CHECK.—James S. Patten, Baltimore, Md. This is an inexpensive door check and stop, with a securing plate attached to the door in the ordinary manner, from which projects an arm on which is eccentrically pivoted an elastic disk. A flattened contact portion extends to each side of the axis of the disk, whereby stop faces at opposite sides of the pivot are provided when the contact portion is turned to engage the floor.

VEGETABLE CUTTER.—James S. Patten, Baltimore, Md. This device has a main supporting frame with a holder for receiving the vegetables, a reciprocating slicer knife, movable in the bottom of the holder, and a presser or follower which serves to press the vegetable against a reciprocating cutter platen or frame. The machine is simple and cheap in its construction, easily manipulated, and very effective for the uses designed.

AWNING.—Rodolph D. Thornton, Brooklyn, N. Y. The construction of this awning is such that the lower portion, which is usually open, may be closed by a screen, thus admitting of the window being kept open without the possibility of flies entering the room. The screen is so made and attached that it may be elevated with the awning, or be brought up close to the sash when occasion may demand. When the awning has a hood, the lower portion of the hood may also be closed with a screen held in fixed position.

DISPLAY STAND.—William E. Stow, Newborn, Ga. This invention provides a special construction and arrangement of parts of a revolving stand for exhibiting goods in connection with a canopy of netting, which may be raised above or lowered around the goods for their protection. Display wheels, on which may be placed sectional shelves, are loosely held upon a central standard, supported upon a suitable base, which is either portable, with casters or rollers, or may be a stationary fixture.

PIANO STOOL.—Charles O. Parsons, Milwaukee, Wis. This is an inexpensive stool, which is vertically adjustable, but which does away with the ordinary screw, and has a revoluble seat, which may be fastened at any desired height, so as not to be accidentally changed. In the central bore of the usual pillar is a sleeve, in one side of which is a vertical row of holes, either one of which may be engaged by the lower end of a spring-pressed latch pivoted in a hollow shaft extending vertically through the sleeve, the upper end of the latch being connected with a horizontal push rod terminating in a push button in the edge of the seat. The button is to be pushed in when the seat is to be raised or lowered, the latch entering the nearest hole when pressure on the button is released.

RAZOR.—Carl R. Evertz, Brooklyn, N. Y. This invention provides a razor stock with a detachable blade, and means for making a quick and secure connection of the blade with the stock or back piece, and to permit the blade to be removed readily and safely for interchange with similar blades. It is designed to furnish a set of blades with a single stock and handle, so that a dull blade may be removed and replaced by a sharp one.

SPOOL THREAD CABINET.—James W. Hayden, Lewisport, Ky. This cabinet has a closing lid or cover, and may be of any size or shape, and within it are cells, preferably arranged in transverse rows or clusters, in which the spools are arranged in single columns, to be delivered therefrom by pulling a knob, which in turn operates a releasing device. The invention covers various novel details of construction and combinations of parts.

WAGON BOX STRAP.—Godfrey W. Bauder, Sheldon, Iowa. This invention relates to that variety of straps used to connect the floor and side pieces of wagon boxes at the corners, and which are also adapted to secure the end boards or gates in place. Its body portion has parallel ribs forming a groove in which the end gate may be held, while a flange overlaps the end of the side of the wagon body, and another flange rests on its top at the corner, the two flanges serving as braces.

LIFTING DEVICE.—Willis L. Brown, Lake Geneva, Wis. This device comprises a light frame, preferably made of gas pipe, to a cross piece at the upper end of which is pivoted a lever, the device being readily set up and adjusted, and arranged for conveniently lifting and supporting stoves, safes, and other heavy objects, for setting or removing them. It may be readily folded up in small space when not in use.

SHELLS FOR PLATED WARE, ETC.—William McAusland, Taunton, Mass. Oval and oblong shells for hollow plated ware are, according to this improvement, produced of ductile or plastic material by first making a round, seamless shell, and then expanding it to an oval or oblong by introducing successively sectional former blocks of different size and shape, to be expanded progressively by a tapering plug forced centrally through. By this method not only metal shells may be shaped, but also those of pasteboard, wood fiber, rubber, and other materials.

GRAIN SCOURER.—Archibald P. Campbell, Portage la Prairie, Canada. This scourer comprises a revoluble perforated cylinder, the perforations adapted to receive the grain and means for delivering grain into the cylinder and removing it therefrom, while revoluble brushes are held to impinge on opposite sides of the cylinder shell. The perforations are slightly larger on the inner side of the cylinder than on the outside, and the kernels of the grain catch in the perforations and are brushed, being thence dropped into a discharge spout.

MUSICAL INSTRUMENT ATTACHMENT.—William Leiner, Milwaukee, Wis. This is a simple device for attachment to harps, zithers, etc., a sliding and yieldingly supported bar above the strings of the instrument carrying dampers adapted to contact with strings, and mechanism for shifting the relative positions of the dampers. It may be conveniently operated to change the key, and is arranged to damp all the strings except those in actual use, thus facilitating easy and nice playing.

RUB FLUTE.—Balilla Carpigiani, Philadelphia, Pa. In a suitable base is held a row of rods of different heights, preferably of wood, each rod terminating in a socket, the sockets being connected together by a silken cord or other brace. Each socket has a removable top section, by changing which the tones of the instrument are changed. The instrument is played with gloved hands, the gloves being resined and drawn longitudinally along the rods, the long rods emitting relatively deep tones and the short rods sharper tones.

MUSIC BOARD.—Harry S. Sharpe, Seattle, Washington. A series of connected bars is provided with notation lines, and between the adjacent bars music characters are adapted to be inserted, each having a rearwardly extending lug to hold the character in proper position relative to the notation lines. The improvement is designed to facilitate the teaching of music, permitting of readily inserting or removing the music characters as desired.

PENHOLDER DESIGN.—Dent L. Lydick, Quaker City, Ohio. This is a combined penholder and paper cutter, whose lower stem portion is a tube, while the upper portion represents a feather, having one straight marginal edge.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THEORY OF STRUCTURES AND STRENGTH OF MATERIALS. By Henry T. Bovey. New York: John Wiley & Sons. 1893. Pp. xv, 817. Price $7.50.

The preface states that this work deals with that portion of applied mechanics which has to do with the design of structures. It therefore will be found to develop into a very full and exhaustive treatise on the strength of material, truss and girder calculations, and all those matters which are now acquiring such importance in the architectural and engineering worlds, where the use of iron and steel of known constants enables exact mathematical calculations to be applied to the practical dimensions of the sizes of the members of bridges and buildings of all kinds.

MANUEL THEORIQUE, INSTRUMENTAL ET PRATIQUE D'ELECTROLOGIE MEDICALE. Par G. Trouve. Paris: Octave Doin, editeur. 1893. Pp. xxii, 788. Price 8 francs.

Gaston Trouve is well known as a constructor of a wide range of electrical apparatus. A great deal of his material was invented for use in a medical application of electricity. The present work is largely devoted to his own different apparatus, but notwithstanding that, his researches and work have been so complete that it will be found a very good treatise on the titular subject. A bibliography is given, and numerous illustrations and tables of data give value to the work.

ENGINE ROOM CHAT. By Robert Grimshaw, M.E. New York: Practical Publishing Company. 1893. Pp. 144. Price $1.

A very graphic presentment of the engineer's difficulties and the advices often given in a humorous or sarcastic vein make this little work excellent reading. The author is known as a very spirited writer, and in this book he has made full draft upon his humorous powers. The advice he gives is excellent, and it really seems as if the presentment of his advices in this humorous form would make it a more suitable dose than when given in more serious shape.

PHOTO-ENGRAVING. A practical treatise on the production of printing blocks by modern photographic methods. By Carl Schraubstadter, Jr. 8vo. Pp. 132, 60 engravings, cloth. Published by the author at St. Louis. Price $3.

This book will fill a want long felt for a treatise which will enable an amateur or professional photographer to make good printing blocks. Zinc etching is by no means an easy process to work, and really requires practical instruction from a man in the business if the highest class of work is to be attempted. With a book like Mr. Schraubstadter's it is possible to make excellent engravings after a few weeks' practice. The process of making wet plate negatives is well described, and full details of the preparation of the zinc, the etching and finishing are given. Half tone work comes in for a share of attention, though the subject is not as fully treated as it might be. The simple and double washout processes, as well as the swelled gelatine process, are also described. Altogether the work is a very satisfactory addition to the literature of the subject, which is by no means meager. It is a book which will be well received by amateurs.

COPY FOR PHOTO-ENGRAVING. By Carl Schraubstadter, Jr. St. Louis, Mo. 24mo. Pp. 25, paper. Price 25c.

A valuable little work giving full information in regard to the paper, pens, and ink which will obtain the best results in the hands of the photo-engraver.

CATALOGUE OF AMERICAN LOCALITIES OF MINERALS. By Edward Salisbury Dana. New York: John Wiley & Sons. 1893. Pp. 51. Price $1.

This reprint of a very practical portion of Dana's Mineralogy will doubtless be acceptable to many collectors, enabling them to get the list of localities at a nominal price.

WATERDALE RESEARCHES; OR, FRESH LIGHT ON THE DYNAMIC ACTION AND PONDEROSITY OF MATTER. By "Waterdale." London: Chapman & Hall, Ltd. 1892. Pp. xvi, 293.

The author has addressed a special preface to his American readers. The aim of the author, it seems, is

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the discovery of some result other than the hypothesis of attraction to account for the gravitation of one body toward another. This will indicate at once that the book is of the inconoclastic type, and shows that the author may be expected, in it, to remorselessly attack modern scientific conceptions. He seems to have covered the ground at great length and after the conclusion of his treatise favors us with about 100 pages of appendix.

DOMESTIC SCIENCE. A book for use in schools and for general reading. (Second and revised edition.) By James W. Talmage. Published by George Q. Cannon & Sons Co. 1892. Pp. 389.

We have gone through this little work emanating from far-off Salt Lake City, and have been most pleasantly impressed by the selection of topics and the judicious way in which they are arranged and treated by the author. He seems to have the talent of making a readable and consecutive work from materials which normally are considered of a somewhat disconnected nature. From what we have seen of it we feel strongly inclined to recommend it to the general reader.

THE COAL TAR COLORS. With especial reference to their injurious qualities and the restriction of their use: a sanitary and medico-legal investigation. By Theodore Weyl. Philadelphia: P. Blakiston, Son & Co. 1892. Pp. xii, 154. Price $1.50.

This interesting work touches upon a subject of growing importance. The toxicology of the coal tar colors has hitherto been rather neglected. The use of such colors not only in textile fabrics, but in food and elsewhere, makes it of unusual importance to understand what their effects upon the human system are. This work is done for us in Dr. Lethman's translation of Weyl's excellent treatise.

ELECTRICAL EXPERIMENTS. A manual of instructive amusement. By G. E. Bonney. London: Whittaker & Co., Paternoster Square, E. C. Pp. xvi, 252. Price 75 cents.

Much that is old, but for that reason none the less interesting, appears in this book. The usual topics of magnetism, induction coil experiments, static electricity and electrolysis are given, and the work will doubtless be of considerable interest to amateurs. Many of the cuts will be recognized as old friends, yet they are all pertinent to the subject.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MARCH, 1893, NUMBER.—(No. 89.)

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1. Elegant plate in colors, showing an attractive dwelling at Springfield, Mass. Floor plans and perspective elevations. Cost $9,750 complete. E. L. Chesebro, architect, Springfield, Mass.
2. Plate in colors showing the residence of the Hon. John J. Phelan, at Bridgeport, Conn. Two perspective views and floor plans. Mr. A. H. Beers, architect, Bridgeport, Conn. An excellent design. Cost $6,000 complete.
3. A dwelling at Springfield, Mass., erected at a cost of $4,000 complete. Perspective views and floor plans. Messrs. Granger & Morse, architects, Springfield, Mass. A model design.
4. A cottage erected near Brighton, Mass., at a cost of $2,800. Floor plans, perspective view, etc. A. W. Pease, architect.
5. Engravings and floor plans of a residence at Greenwich, Conn. A beautiful design in the Colonial style of architecture. Mr. W. S. Knowles, architect, New York.
6. A dwelling recently erected at Brookline Hills, Mass., at a cost of $5,300 complete. A picturesque design. Perspective elevation and floor plans. Messrs. Shepley, Ruton & Coo idge, architects, Boston.
7. Sketch of a tasteful design for a three-family cottage, to cost about $4,500.
8. Plans and elvations of an English cottage of quaint and pleasing design.
9. View of the Fifth Avenue Theater, New York. A splendid example of modern architecture in the style of the Italian Renaissance. Together with a portrait and biographical sketch of Francis H. Kimball, architect, New York City.
10. Misscellaneous contents: Paving estimates.—World's Fair items.—Painting the World's Fair buildings.—Drawing instruments for colleges, etc., illustrated.—A tasteful fireplace design, illustrated.—An improved steel spring hinge, illustrated.—Vegetable growth in water mains.—American machinery in London.—A foot radiator valve for hot water radiators, illustrated.—New tin plate plant.—An improved furnace, illustrated.—Cincinnati woodworking machinery.—An improved door hanger, illustrated.—A big heater company.

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Stow flexible shaft. Invented and manufactured by Stow Mfg. Co., Binghamton, N. Y. See adv., page 174.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Portable engines and boilers. Yacht engines and boilers. B. W. Payne & Sons, Elmira, N. Y., and 41 Dey Street, New York.

For Sale—Patent on improved mine car. See illustrated notice on page 180. For terms and particulars address Homer Durand, Starkville, Col.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Perforated Metals of *all* kinds and for *all* purposes, general or *special*. Address, stating requirements, The Harrington & King Perforating Co., Chicago.

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Hydrocarbon Burner (Meyer's patent) for burning crude petroleum under low pressure. See adv. page 381. Standard Oil Fuel Burner Co., Fort Plain, N. Y.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(4757) N. N. writes: I have an artesian well 612 feet deep, 5 inches diameter, and flows 190 gallons of water a minute. How much power can I get from it, and in what way can I test the pressure of it with a steam gauge? A. We should know the height that the flow of water can be utilized for power, as well as the quantity. You can reduce the area with a 2 or 3 inch hole in a pipe cap and find the height of the jet. You may also tap the side of the pipe for a gauge and close the top for the total pressure. Can you give the vertical height of the stream from the open pipe? With the water that is flowing, if you can get 20 feet fall, you can realize ¾ of a horse power.

(4758) R. V. De B. writes: It is proposed to feed a reservoir from a lake situated on a higher level. The lay of the land is such that a canal with a slight but continuous fall could be constructed from the lake to the reservoir, the water in the canal running at the rate of say one foot per second. Would there be any objection to the construction of an open canal, 3 feet deep, on account of the formation of ice in winter or from other causes? A. The question of climate should decide the matter of an open water ditch. In your climate slow-running water is liable to freeze from 2 to 3 feet thick during the coldest winters. If the reservoir is small, so that there is necessity for constant flow through the ditch, it will be at considerable risk to depend upon its supply during prolonged cold weather. If the cost is not a bar, we recommend cast iron pipe, or if within the range of size, glazed tile pipe is cheap and serviceable where there is no pressure.

(4759) E. R. F. asks: If the air contained in a cylinder 8 inches long and 1½ in diameter is compressed into ⅛ of that space, with the pressure of how many atmospheres would it rest on a square inch of surface? If the same quantity of compressed air should suddenly be released and escape from the cylinder through a tube ¼ of an inch in diameter, and in its passage through the tube encounter a bullet weighing ½ ounce, what force in pounds would it exert on the bullet, and how far and with what force or penetrating power would such a force drive it (the bullet)? A. The pressure as stated will be about 150 pounds per square inch, depending upon absorption of the heat of compression and leakage. The isothermal pressure=103 pounds=7 atmospheres. The adiabatic pressure=235 pounds=16 atmospheres. If the air were let into the air gun at the instant of compression, the pressure upon the bullet would be about 200 pounds per square inch and would eject the bullet with a velocity of about 500 feet per second, having a range of from 100 to 200 yards, according to smoothness and length of barrel and facility for giving free vent of the compressed air to the barrel. The force of impact would be that due to about 15 foot pounds.

(4760) W. K. M. asks: Has the process of tempering aluminum been discovered yet, and is it possible to use it in the open air without fear of its tarnishing? Also please state the comparative weight and tensile strength of steel, copper, and aluminum. A. The process of tempering aluminum has not been discovered, except by alloying with other metals. It does not readily tarnish in the open air. Aluminum, 26,000 pounds per square inch tensile strength, weight 168 pounds per cubic foot; copper, 30,000 to 33,000 pounds per square inch tensile strength, weight 552 pounds per cubic foot; steel, 70,000 to 90,000 pounds per square inch tensile strength, weight 490 pounds per cubic foot. See a valuable treatise on "Aluminum: its Manufacture, Properties, Alloys, and Working," by J. W. Richards, $5 mailed.

(4761) F. W. W. says: I have a few hives of bees which I keep for pleasure. Ever since I first had them, my extracted or strained honey has sugared or crystallized. This takes away its fine flavor, as some of the sugar will not melt on being heated to the boiling point of water. I have kept this honey in a warm room, and have also tried a cold one without attaining the desired result. The honey is extracted by removing the caps of the cells and whirling the combs in a honey extractor. My neighbor, who also has a number of hives, is troubled in the same manner. The honey was extracted in July. Do you know of any way of preventing this crystallizing without detracting from the value of the honey? A. There is a possibility that your bees have been feeding on sugar, which makes crystalline honey. Otherwise the centrifugal extractor may carry too much air through it, evaporating part of the moisture. Try moistening the air of the extracting room with steam while the work is being done. A boiling pan of water may answer the purpose.

(4762) C. G. C. asks: Will there be a gain (if so, how much?) in mixing hot air (furnace gases) with steam in working an ejector (pump) to lift cold water on high lifts to prevent condensation of steam? What proportion of hot air would be most useful? A. Hot air mixed with steam in an ejector is of but little or no value, and without pressure decreases its working power, and in any quantity nearly destroys its lifting power. The power of an ejector to lift and force water is in the property of steam to condense and disappear as a vapor at the instant of imparting its velocity to the water. Air mixed with the steam retains its gaseous volume in the receiving nozzle of the ejector and occupies the space that would otherwise be occupied by the water jet. Air alone is of little value in a water ejector. Will soon publish something on ejectors.

(4763) W. C. R. asks: How can I count the flaps of a small bird's (sparrow) wings, and how may I compute the area of a bird's wing which is somewhat irregular in form? A. You can only approximate the wing vibrations of small birds by eye comparison with a wing fitted to a vibrating mechanism with a variable power and registering index. The area may be computed by sectional divisions of a drawing to be made exactly of the size and shape of the wing.

(4764) Subscriber asks: Can wood carbon be used instead of battery carbon in an arc light? A. Wood carbon was the material used in producing the electric arc by Sir Humphry Davy, but it is not as good as the manufactured carbon made from powdered coke. The old authorities used to recommend saturating it with mercury to improve its conductivity. 2. Is there any way of changing heat direct into electricity? A. The nearest approach to the direct conversion of heat into electricity is found in the thermo-electric battery.

(4765) H. G. asks: What explosive powder when mixed with powdered magnesium will cause a powerful instantaneous flash, suitable for photographic purposes? A. Magnesium powder, 6 ounces; potassium chlorate, 12 ounces; antimony sulphide, 2 ounces; 75 to 150 grains of the powder should be used.

Magnesium	40 per cent.
Permanganate of potassium	40 "
Peroxide of barium	20 "

(4766) A. D. M.—A good cement for celluloid is made from 1 part shellac dissolved in 1 part of spirits of camphor, and 3 to 4 parts of 90 per cent alcohol. The cement should be applied warm, and the broken parts securely held together until the solvent has entirely evaporated.

(4767) G. M. R.--The designs for watch works are made on an enlarged scale, generally ten times the size, which makes the actual dimension expressed with a decimal point one digit to the left. There is no haphazard work in watch making or in the machinery for producing the parts.

(4768) E. R. S. asks: 1. What book is there on friction, suitable for a young student, yet giving practical calculations, such, for instance, as finding the horse power required to keep an axle or shaft turning at a required speed (the dimensions of the shaft and its weight being known)? A. We recommend Thurston's work on "Friction and Lost Work in Machinery," $3, mailed. Also our SUPPLEMENT, Nos. 572 to 576, for an admirable series of articles on friction. 2. If the resistance of the air is not taken into account, does the speed with which an axle or shaft will revolve in its bearings vary as the horse power applied? A. Friction varies with the speed, and relatively decreases in proportion to the increase of work in revolving machinery. 3. What book is there, showing how to calculate an electric motor to produce a certain horse power? A. Dynamo calculations are given in Sloane's "Arithmetic of Electricity," $1 by mail. Multiply the desired horse power by 746, divide by the potential difference at your disposal. This gives you the amperage. Then calculate on the lines of a dynamo of similar factors.

(4769) R.—No one has the right to make a patented article for his own use without consent of the patentee.

(4770) O. M. W. writes: I have built a small electric machine, windings and pattern after the 8 light dynamo described in the SCIENTIFIC AMERICAN, except size; armature 3¼ inches long, 2 3-16 inches in diameter; magnet waists oval, 1×2 inches; 4 inches long, magnet coils 18 wire gauge; armature No. 20; 16 commutator bars; each armature coil six turns per layer, two layers deep. As a motor it seems to be a success, but as a dynamo a complete failure; can only get a current of seven-tenths ampere up to 1800 revolutions, above that speed less. What is the trouble? What sized wire and what manner of winding can I get the largest amperage as a dynamo, using very soft cast iron magnet or very soft forged iron magnets? Magnets and armature size as above. A. The iron used in a field magnet should always be as soft as possible. If the iron in your magnet is hard, it accounts for your failure. With No. 18 wire on the field magnet you should use your machine as a series wound machine. If you find the resistance is too great with the two arms of the magnet in series, you can put these in parallel. If you desire to use the machine as a shunt wound machine, the resistance of the field magnet is not great enough. Probably the winding of the field magnet for a shunt machine should be of No. 22, or possibly No. 24 wire.

(4771) W. H. D. writes: I want to know about the resistance necessary for a ⅛ horse power motor when running it with fan on a 500 volt T. H. street railway circuit, with amperage bearing as high as 240. You will do me a kind favor by letting me know through your valuable paper how many ohms resistance it will take. A. An electrical horse power is 746 watts. A watt is an ampere multiplied into a volt. The current in amperes equals the electromotive force divided by the resistance. You have an electromotive force of 500 volts; for ⅛ horse power you require 93 watts. You will therefore need about 5 amperes of current, and a consequence your machine will need to have a resistance of 100 ohms.

(4772) W. A. S. writes: I have been trying to smelt tin cans, tin clippings, and all kinds of rough iron scrap, in a common straight cupola such as all foundries use, and have been unable to get any iron. There is a great quantity of slag, which is very thick and tough, and in a short time fills the tuyere holes and won't let any wind through. We have not used anything for flux. A. You cannot run down wrought iron scrap in a cupola. It should be piled in masses of 100 pounds or more, heated in a reverberatory furnace and welded with a power hammer. The tin scrap may be used in small quantities with cast iron in the cupola.

(4773) C. E. B. asks how big a space he needs for the gas in a gas engine with a cylinder 1½ inches in diameter and a stroke of 2½ inches, also how big space he requires for the compression of the air. A. A compression gas engine uses about 1 part of gas to 7 or 8 of air. We think you will find it extremely difficult to operate an engine of the size given. The space for the gas and air varies with the system upon which you propose to run a motor. If you are running it without washing out the cylinder with air before each explosion, you will need a space twice as large as that required for the combustible mixture. If, however, you wash the cylinder out, the space for gas and air need be only large enough to contain the combustible mixture when compressed.

(4774) M. T. B.—Your proposed improvement in telescopes would have no value, as the defects of each telescope and mirror would be multiplied; furthermore, each reflection and each refraction of the light absorbs an appreciable quantity, so that your telescope would lack in illumination as well as defining power.

(4775) W. M. C.—(1) First select a clean perfectly fitting cork for each bottle. Then melt your salve and pour it into the bottles from a vessel provided with a spout, taking care in doing so not to allow any of the grease to touch the inside surface of the neck. (2) There is nothing dangerous in the use of the inhalations recommended to you for the asthma. (3) You will find a valuable article on the "Etiology and Cure of Asthma" in SCIENTIFIC AMERICAN SUPPLEMENT, No. 589. Price 10 cents.

(4776) E. F. S. writes: I was in a store the other day, and saw a clerk take a cotton string about six or eight inches long (common wrapping twine) and stick it to a glass showcase on the inside with a piece of wet paper across the middle and let both ends hang down alike, but opposite each other, from the round side of the showcase. Then he rubbed the back of his hand on the outside of the glass, and the strings began to move backward and forward until the one nearest the hand hit the glass and stuck to it; the other end stood out the other way, and became rigid. Some said that it was electricity, and some magnetism. Please tell us what it was. A. The results which you describe are probably due to frictional electricity generated by rubbing the glass with the hand.

(4777) A. A. asks what size wire to wind the four cores of a small shunt wound dynamo, the cores of which are 4 inches by 2 inches by ⅞ inch. I wish to wind these with such wire as will, when wound to about 5-16 inch thick all over, permit about 1 ampere of current only to pass through the coils. The armature is 2 inches by 4 inches, wound with No. 20 wire, with which I expect to get 4 amperes and 50 volts. A. You will need about 1,000 feet of No. 27 wire for your field magnet.

(4778) T. B. writes: I have a magnet that I wish to wind to obtain best results. The size of the cores is 2 inches long and 5-16 inch in diameter. What size and quantity of wire shall I wind on bobbins? A. Wind each core of your magnet until the thickness of your wire equals the thickness of the core. If you intend to use the magnet for local work, No. 24 magnet wire would be the best size for the winding.

(4779) G. A. G. asks: How far will the electricity now in use on the electric street railways jump

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from one trolley wire to the other, supposing the wires to be cut, and how far would the electricity jump, supposing I extended an additional wire from the trolley wire toward the ground or rail? A. The current on a trolley will not jump across a space until the wires are first placed in contact and then separated so as to form an arc. When the wires are touched and separated, an arc of probably two or three inches might be produced.

(4780) G. T. W. asks: Are there two kinds of electricity? How are the batteries made they use on railroads for telegraphy? They are not gravity batteries. They look white, as if made of some kind of salt. A. The idea of two kinds of electricity was exploded long since, although they are sometimes spoken of now as positive and negative electricity. The batteries to which you refer are probably the Edison Lalande batteries. You will find a description of this battery in SUPPLEMENT, No. 792.

(4781) C. M. asks: 1. Regarding the speed of electricity, how fast does it travel through or over a cable? A. The speed of electricity varies greatly under different circumstances. In the Atlantic cable it is very much retarded, so that it requires two or three seconds to send a signal. The speed of electricity under the most favorable circumstances is about the same as that of light, viz., 185,000 miles per second. 2. Can water be compressed? A. Water can be slightly compressed.

(4782) J. B. asks: What pressure of steam is carried on the boilers of passenger steamers on the ocean, using triple and quadruple expansion condensing engines? A. Steam pressures on boilers of large ocean steamers is 125 to 180 pounds per square inch.

(4783) P. & M. ask: What link in a moving train of 20 cars has the most weight on it? Please answer in order to settle a wager. A. The first link.

(4784) A. W. B. asks the method used in adjusting the cork used in making the joints of certain wood wind instruments, as the clarinet, flute, and others. A. The corks for flutes, clarinets, and other instruments are cut by means of thin tubular cutters. They are secured to the joint of the instrument by means of bichromatized glue or marine glue.

(4785) H. W. R. asks: 1. For recipe for the most durable whitewash for trees. Also for wood fences, if different. A. For a durable whitewash for trees and fences, 1 bushel best white lime, slaked in boiling water. Add to the cream 4 pounds sulphate of zinc and 2 pounds common salt dissolved in water. Make the mixture thin enough to use with the brush. If a light brown color is required, add a little hydraulic cement, ocher for yellow and Venetian red for pink or red. 2. How can we best make cinders from our boilers available for durable walks? If to be mixed with cement, what kind of cement and in what proportion? A. For walks of cinders and ashes use one part of hydraulic cement to equal parts of sifted cinders and fine ashes or sand. Lay coarse cinders on the bottom, roll or ram hard and finish with the cement mixture from one to two inches think, as you can afford.

(4786) W. J. M. asks: What government holds the fastest cruiser and the highest speed attained by the same for certain length of time? A. The Argentine government, 22 knots, six hours.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(4687) Answering No. 4687, the method of winding Thomson-Houston spherical armatures is as follows: Two shells of cast iron form heads, iron bridges are put from one head to the other and these wound with iron wire, forming an oblate spheroid. An insulating covering is put on and the surface divided into six sections by wooden pegs. Beginning at end of shaft opposite from the armature, one half of No. 1 coil is wound in sections opposite one another. Armature is turned next 120° and ⅓ of No. 2 coil wound. Turn 120° and wind whole of No. 3 coil. Turn 120° and wind remainder of No. 1. Turn 120° and wind remainder of No. 2. Connect all of inside ends together and carry outside ends to commutator segments. A 9·6 A. 1250 V. dynamo of this make has 10 ohms No. 7 B. and S. wire on field magnets and 12,075 feet No. 12 B. and S. on armature, the resistance of the coils averaging about 13·25 ohms, two always being in series. Such an armature weighs about 520 pounds. J. G. (4693) will, I think, find that article he refers to in the *Electrical World*. It was published in 1889 or thereabout, in the early part of the year.—C. M. D.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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March 14, 1893,

AND EACH BEARING THAT DATE.

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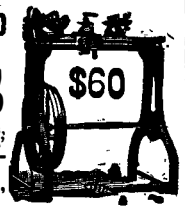

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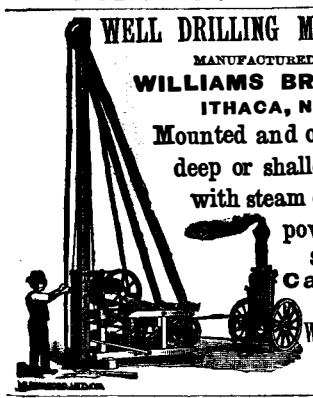

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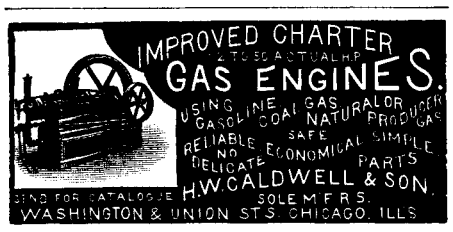

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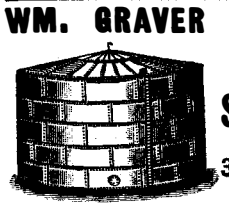

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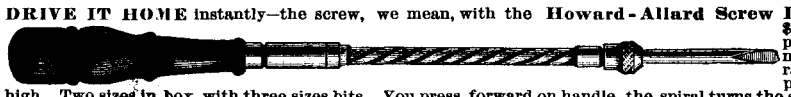

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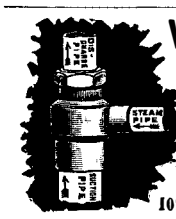

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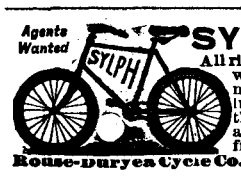

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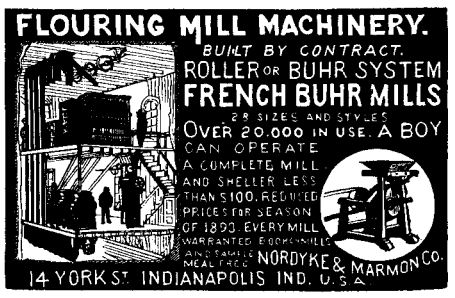

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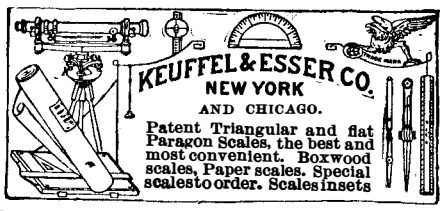

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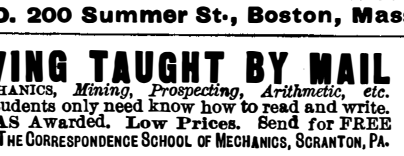
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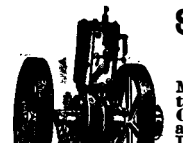

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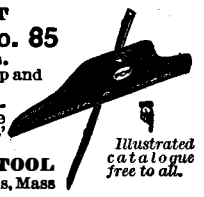

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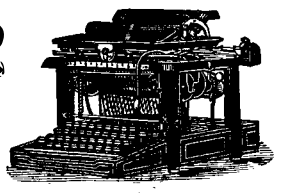

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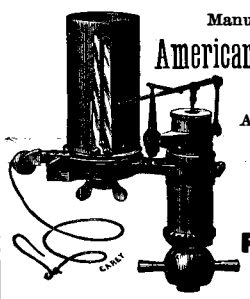

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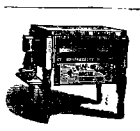

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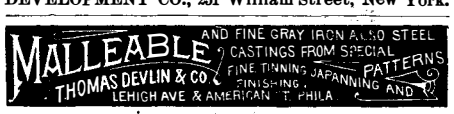

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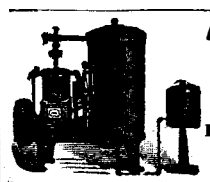

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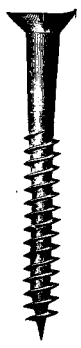

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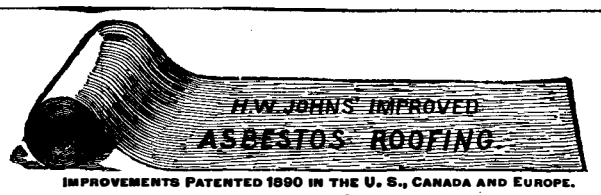

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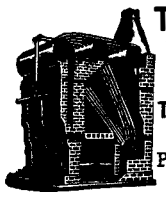

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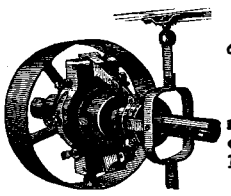

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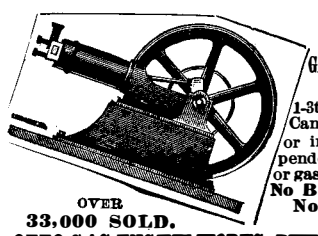

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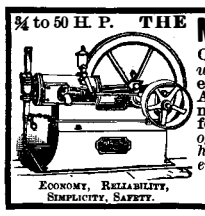

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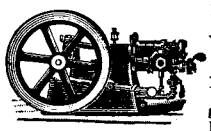

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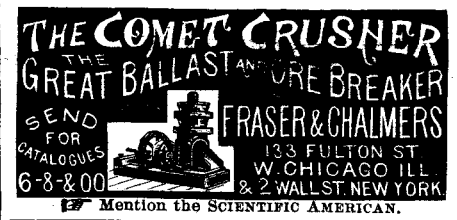
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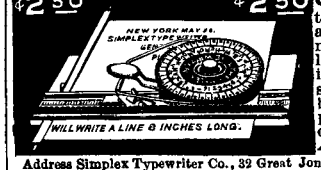

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